Migration and Regional Development

Dissertation
zur Erlangung des Grades eines Doktors der Wirtschaftswissenschaft
der Rechts- und Wirtschaftswissenschaftlichen Fakultät
der Universität Bayreuth

Vorgelegt
von
Paul Berbée
aus
Fulda

Dekan:	*Prof. Dr. André Meyer*
Erstberichterstatter:	*Prof. Dr. Sebastian T. Braun*
Zweitberichterstatter:	*Prof. Jan Stuhler, Ph.D.*
Tag der mündlichen Prüfung:	*13.06.2023*

Acknowledgements

Above all, I would like to express my gratitude to my advisors, Sebastian Braun and Jan Stuhler, for their excellent guidance and support throughout my dissertation journey. Collaborating with them allowed me to benefit and learn from their exceptional expertise, academic rigor, and structured working style. Their feedback, suggestions, and encouragement were a constant source of motivation and inspiration and greatly influenced my own work. I am truly fortunate to have had such remarkable and friendly supervisors and could not have asked for a better duo to guide me.

I am also grateful to my other co-authors, Katrin Sommerfeld, Alfred Garloff, Richard Franke, and Herbert Brücker for their valuable support, insightful discussions, and close collaboration. My work would not have been possible without the team effort we shared.

Furthermore, I am thankful to the members of the IMES junior research group, in particular, Katia Gallegos Torres, Martin Lange, Marvin Brinkmann, Katja Möhring, and Elias Naumann. Our regular meetings, interdisciplinary exchange, and feedback on academic and practical matters have provided me with valuable perspectives and enriched my research. I also would like to express my gratitude to the members of the scientific committee of IMES and the Faculty of Law, Business and Economics at the University of Bayreuth for their support and feedback.

I express my gratitude also to the colleagues from the ZEW Research Unit on Labour Markets and Social Insurance and the community of PhD students at the ZEW, for creating a collaborative atmosphere, fostering friendships, and providing mutual support. I would like to extend a special recognition to the "scrumademics"–crew for starting each workday with a friendly meeting, which helped me stay focused and effectively structure the final phase of my dissertation. I am also thankful to the research assistants at ZEW for their valuable and reliable support in literature research and working with large datasets, in particular Michael Hebsaker, Inga Fehmer, César Barreto, Santiago Rey-Sanchez Parodi, Felix Winkelmayer, and Aizad Qadir Khan,

In addition, I would like to extend my gratitude to the staff of various research data centers, particularly at the IAB, the Statistical Office of Baden-Württemberg, the German Pension Insurance (DRV), and the Federal Agency for Migration and Refugees (BAMF), for their valuable support, helpful counseling, and willingness to answer my specific requests.

Last but certainly not least, I am also greatly thankful to my friends and family, especially Theresa, for their unwavering support, encouragement, and love.

Contents

List of Figures

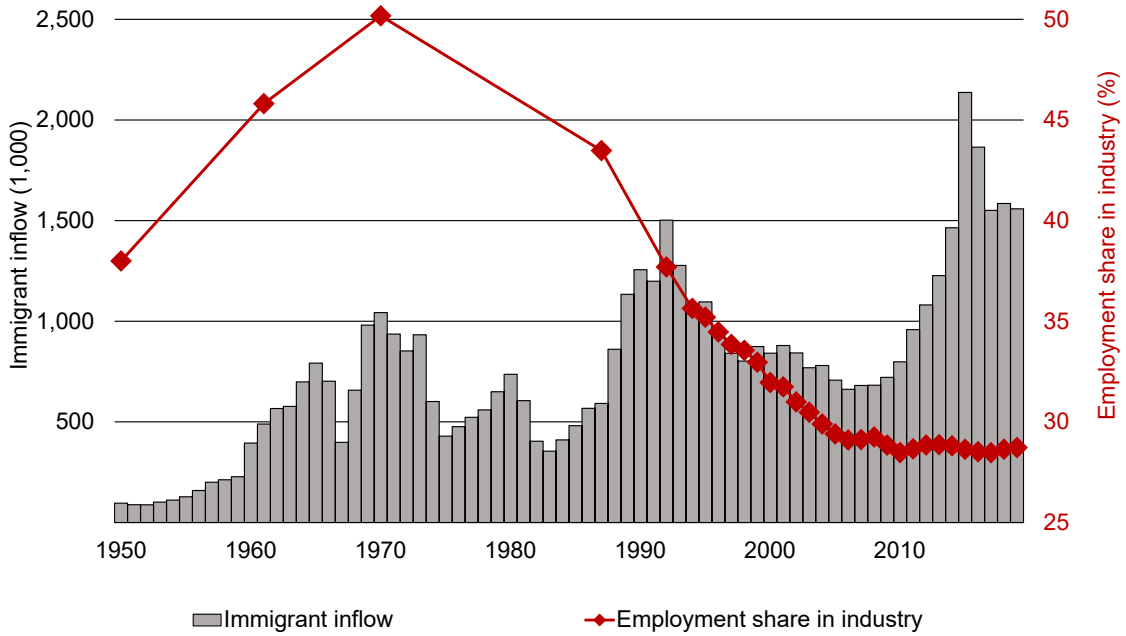
List of Tables

Introduction

Immigration and regional inequalities resulting from structural change are not only subjects of controversial academic debates, but also leading policy issues in many industrialized economies. Both topics are closely interlinked and are likely to become even more relevant in the coming decades. In aging societies where skilled labor becomes increasingly scarce, immigration can help alleviate pressure on the welfare state and bring new ideas, skills, and entrepreneurial spirit to the country (Akcigit, Grigsby & Nicholas, 2017a; Kerr, Kerr, Özden & Parsons, 2016; Bosetti, Cattaneo & Verdolini, 2015). At the same time, innovation and skills are crucial to maintain wealth and competitiveness when old industries go into decline and new opportunities emerge. If managed effectively, both immigration and structural change can play a vital role in supporting the demographic transition and the transition to a sustainable, green economy. However, they can also have negative consequences. For instance, if migrants do not integrate well into the labor market, lack the necessary skills, or struggle more than other workers to undergo retraining and update their skill sets, this can lead to high monetary costs, social tensions and political polarization (Bratsberg, Raaum & Røed, 2010; Riphahn, 2004). If certain regions fall behind the rest of the country as a result of deindustrialization and lack new labor market opportunities, this can lead to further social and economic disparities (Rodríguez-Pose, 2018). Given the relevance of these issues, both for research as well as for policy makers, the four chapters of this dissertation aim to provide new insights on (i) the effects of immigration on incumbent workers, (ii) regional inequality and its sources, (iii) the integration of immigrants into the labor market, and (iv) how these three aspects are interlinked.

This dissertation focuses on Germany which is a particularly relevant and interesting case as an immigration country: Since the 1960s, Germany has gradually become the world's second-most important destination country for international migrants after the United States. By 2021, the stock of foreign-born population reached 13.6 million, or 17.1% of the entire population. The grey bars in Figure 1 depict the influx of new immigrants into Germany since 1950, with peaks during manpower recruitment in the early 1970s, following the fall of the Iron Curtain, and in the 2010s. When only considering new immigration flows since 2011, no other country worldwide has taken more immigrants than Germany (OECD, 2023). This is due in part to the fact that as Europe's largest economy, with employment levels reaching record highs, Germany has attracted millions of migrant workers, both from within and outside the European Union. In light of a severe demographic deficit, many regions have reached near full employment and large industries are facing severe shortages of skilled labor. Therefore, the recruitment of foreign

FIGURE 1: IMMIGRANT INFLOWS AND INDUSTRIAL EMPLOYMENT SHARE
1950-2019



Notes: Annual inflows of international migrants to West Germany 1950-1990 and inflows to reunified Germany, including East Germany 1991-2019 (Statistisches Bundesamt, 2021a). Share of total employment in industry, measured for West Germany based on the population censuses 1950, 1961, 1970, 1987 and GDP figures 1992-2019 (Arbeitskreis VGR der Länder, 2021).

labor has become a priority for policy makers once again, as during the post-war boom when German firms hired "guest workers" from Southern Europe and Turkey. On the other side, Germany has been a major destination for refugees in recent years, in particular for those fleeing the Syrian civil war around 2015 and the 2022 Russo-Ukrainian war. By the end of 2021, about 1.9 million refugees were living in Germany, not including about 1 million Ukrainians who arrived during 2022. The accommodation of refugees was accompanied by wide-spread solidarity, but also by controversial debates and protests on cultural differences, unfavorable integration prospects, and the potential burden on the welfare state.

Germany is also a highly relevant example when it comes to regional disparities, structural change and (de-)industrialization: In contrast to other advanced economies, Germany has maintained relatively high employment shares in industry (28% in 2019, compared to 20% or less in the US, France or the UK). Southern Germany in particular is a major economic powerhouse with a highly competitive manufacturing sector, while in the North and North-West that industrialized earlier in the 19th century have fallen behind and continue to struggle with structural change. The red lines in Figure 1 illustrate late industrialization in West Germany between 1950 and 1970 and accelerating deindustrialization during the 1990s. These structural transformations occurred simultaneously with large immigration events and had a major impact on the labor market opportunities of both established and newly arrived migrants. (Chapter 4 and Wiedner & Giesecke, 2022).

The following paragraphs provide an introduction of the key topics, research questions, and contributions of each chapter in this dissertation, as well as the distinctive characteristics of the data sources used. A summary of the findings will be provided in a separate section.

Chapter 1 examines the impact of immigration on regional labor demand (joint work with Herbert Brücker, Alfred Garloff, and Katrin Sommerfeld). While the labor supply effects from immigration on labor markets have been extensively studied (and empirically isolated by Dustmann, Schönberg & Stuhler, 2017 and Beerli, Ruffner, Siegenthaler & Peri, 2021), labor demand effects from immigration have not been a focus of academic and public debate. Nonetheless, immigration-induced demand has the potential to affect the wages or employment of domestic workers substantially and to counteract potentially negative labor supply effects. However, in most contexts it is empirically impossible to isolate labor demand effects from immigration, because they occur simultaneously with supply shocks. Chapter 1 fills this gap by exploiting the natural experiment of the large and unexpected inflow of refugees to Germany around the year 2015. Refugees were allocated to regions by a dispersal policy and were not allowed to work during the first months after arrival. At the same time, they strongly increased local demand for locally produced goods and services, consuming high shares of non-tradable necessities and requiring personnel-intense support in administration, social work, and accommodation. First of all, this chapter offers a novel and valuable contribution by identifying and isolating labor demand effects of immigration. The identification strategy that is based on regional allocation quotas and the presence of vacant military bases can also be applied to other questions and will be useful for future research on the effects of refugee immigration in Germany and beyond. Secondly, the chapter also makes a significant contribution to the literature by developing a framework for analyzing the labor market effects based on non-homothetic demand. This framework allows for a systematic analysis of the different demand patterns of immigrants and natives and their labor market implications, which sets it apart from earlier works (Bodvarsson, Van den Berg & Lewer, 2008; Borjas, 2013). Finally, Chapter 1 also contributes to the debate on the economic effects of hosting refugees. It demonstrates that refugees boost the local economy and generate new employment opportunities for the resident population through the goods and services they consume. This argument should be considered by researchers an policy makers not only in discussions on the costs and benefits of accommodating asylum seekers, but also in many other migration contexts. Summarizing, Chapter 1 adds to the existing academic literature and the overarching themes of this dissertation by examining a novel perspective on the short-term effects of immigration on regional labor markets.

Chapter 2 studies the effects of early industrialization on long-run regional development (joint work with Sebastian T. Braun and Richard Franke). In recent decades, regional income disparities in advanced economies have been increasing (Rosés & Wolf, 2018a; Gaubert, Kline, Vergara & Yagan, 2021), which contributes to growing inequality

and may threaten social cohesion and political stability. Many declining regions which are characterized by a lack of economic opportunity, social problems and rising political tensions had a high share of industrial jobs in the past and are now struggling with the impacts of deindustrialization (Rosés & Wolf, 2021). Against this backdrop, Chapter 2 tests the hypothesis whether early industrialization was first conducive and later detrimental for economic development and explores the implications for the marked changes in Germany's economic geography observed in recent decades. As a first important contribution, it provides a comprehensive descriptive analysis of the spatial distribution of economic activity in West Germany between 1926 and 2019 using a novel dataset of 163 labor market regions. Second, it quantifies the causal impact of early industrialization, measured as the industrial employment share in 1882, on the spatial economic development over time, asking to what extent regional differences in early industrialization can explain the changing fortunes of West German labor markets over the past century. Finally, the study discusses potential mechanisms, with a focus on innovation and the role of rigid local political environments in addition to human capital accumulation which previous studies emphasized (Franck & Galor, 2021; Esposito & Abramson, 2021) . The findings of this chapter have important implications for the policy discourse on regional inequality and economic decline, as they show that the interpretation of contemporary changes in regional inequality requires careful consideration of the past, and that initial gains from industrialization can come at the expense of long-run losses. Overall, Chapter 2 advances the literature and contributes to the themes of this dissertation by studying the long-term origins of current regional inequalities and investigating the processes that drive them.

Chapter 3 examines the labor market integration of immigrants from a long-term perspective (joint work with Jan Stuhler). Despite the significant contributions that immigrants make to the German economy, there has long been a lack of acknowledgement from policy makers and the public that Germany is an "immigration country". As a result, many migration episodes have been unexpected and not the result of explicit immigration policies. Chapter 3 provides extensive evidence on the labor market integration of immigrants in West Germany over the last 50 years and compares the results to findings from the US literature (Cadena, Duncan & Trejo, 2015; Borjas, 2015). To accomplish this, the study utilizes cumulated data from 30 waves of the *microcensus*. The long-term horizon and the extraordinary large sample sizes of the dataset allow for a more detailed review of employment rates and income for specific immigrant cohorts over the years than any previous study. Offering new insights into ongoing debates in the migration literature, Chapter 3 examines which migrant groups experience assimilation, how long this process takes and whether migrants eventually fully catch up to natives (Sprengholz, Diehl, Giesecke & Kreyenfeld, 2021; Gathmann & Monscheuer, 2022). It also explores the predictability of integration outcomes and tests whether integration outcomes have improved or worsened over the past five decades in light of Germany's increasing policy focus on integration support (Kogan, 2011, 2016). Chapter 3 concludes with two case

studies that highlight the relevance of changing economic conditions for the labor market integration of immigrants: The first case study illustrates the sudden and dramatic employment decline of Turkish migrants during the early 1990s. The second case study compares the labor market integration of recent refugees who arrived during the 2015 European refugee crisis and the 2022 Russo-Ukrainian war with earlier cohorts and predicts their likely integration paths. The detailed analysis provided in this chapter offers valuable insights for policy makers, enabling them to identify the most vulnerable migrant groups and key risk factors affecting their labor market integration. Summarizing, Chapter 3 contributes to the academic literature and the main themes of this dissertation by investigating the integration of immigrants over more than 50 years and emphasizing the importance of changing economic conditions in shaping this process.

Chapter 4 studies how new immigration and structural transformations impact the integration of established migrants. In the economic literature, the labor market integration of immigrants is commonly viewed as an assimilation process, in which immigrants become more similar to natives over time. However, there is evidence that some migrant groups actually experience a divergence in their labor market outcomes over their lifecycles (Wiedner & Giesecke, 2022; Bratsberg et al., 2010). Using the example of so-called "guest workers" from Southern Europe and Turkey who were recruited by German firms during the 1960s and 1970s, the chapter evaluates the extent to which changing conditions and economic shocks can negatively impact the labor market integration of certain migrant groups, particularly in their older ages. The study utilizes unique panel data based on pension accounts dating back to 1951, which allows for a comprehensive examination of the entire careers of these immigrants in Germany. Descriptive evidence illustrates that these migrants had enjoyed relatively stable employment rates for 20-30 years, when in the early 1990s many Turks lost their jobs and faced long periods of unemployment or substantial wage cuts. Recruited workers from other origin countries were barely affected. This study documents that the particularly unfavorable labor market outcomes of Turks did not persist throughout their entire careers, but rather arose as a result of specific events that occurred within a few years. The chapter estimates the causal effect of new immigration shocks, the employment drop during the 1993 recession, and task-biased technical change on their labor market outcomes. Unlike previous studies that have documented the higher sensitivity of immigrants to economic downturns and new immigration events (Bratsberg, Barth & Raaum, 2006; Dustmann, Glitz & Vogel, 2010; D'Amuri, Ottaviano & Peri, 2010; Brücker & Jahn, 2011), this chapter does not treat incumbent migrants as a homogeneous population group, but rather highlights the significant heterogeneity in their responses to changing economic conditions, depending on their career stages and origin regions. Another important contribution of the chapter is the evidence that selective return migration may partially explain different responses to economic shocks (Adda, Dustmann & Görlach, 2022). In times of persistently high migration flows and troubled economic outlooks, these findings are of particular policy relevance for many industrialized countries where large migrant cohorts are growing

old. With regard to the overarching themes of this dissertation, Chapter 4 synthesizes the findings from the previous chapters and aims to improve our understanding of the complex interplay between immigration, integration, and economic development.

Throughout the entire dissertation, a cross-cutting feature is the use of novel and innovative data sources. In Chapter 1, the analysis is based on a collection of unique administrative data on the assignments of refugees to reception facilities and districts, including complete lists of distribution quotas and vacant military bases that were available to be rented out as provisional refugee housing. This data was directly obtained from the responsible authorities and has not been used in previous research. In Chapter 2, a novel database on regional GDP per capita for West Germany is created, covering the period 1957-2019 and complemented with historical data from tax statistics and 19th century censuses. A large portion of this data had to be retrieved from printed volumes and harmonized to 163 labor market regions, which is a much finer level of disaggregation than previous studies have used. In Chapter 3, questionnaires from 30 waves of the German microcensus over the years 1976-2015 have been harmonized, resulting in the largest, most comprehensive, and most representative dataset to study the integration of immigrants that is available for Germany. In Chapter 4, administrative data of merged pension accounts and social security registers (BASiD) is used, which is the only individual panel data dating back to the recruitment period of the so-called "guest workers" 1955-1973. This is the first study to exploit the entire time horizon that this data set covers, tracking individuals over their entire working lives until retirement and a major improvement compared to earlier research. Each of these data sources will be of significant value for future research.

In conclusion, this dissertation offers new and valuable insights into the economic effects of immigration and structural change in Germany. By examining the impact of new immigration on incumbent workers, regional inequality and its sources, and the integration of immigrants into the labor market, it sheds light on important and relevant issues that are crucial for addressing the economic and social challenges of the future. The findings presented in this dissertation can inform policy decisions and contribute to academic debates in the field of migration and economic development, providing a deeper understanding of these complex and interrelated issues.

Summary

This dissertation presents an in-depth examination of specific aspects of immigration, labor market integration, and regional inequality in Germany. Through four chapters, the dissertation explores the impact of new immigration on incumbent workers, the sources of regional inequality, the integration of immigrants into the labor market, and how these topics are interlinked. The chapters provide new insights and contribute to the academic literature on these topics, while also being highly relevant to policy-making. The empirical analysis in each chapter utilizes novel and innovative data sources and econometric methods.

Chapter 1 (joint work with Herbert Brücker, Alfred Garloff and Katrin Sommerfeld). The first chapter examines the demand effect of immigration on local labor markets by exploiting the fact that refugees in Germany are banned from working in the first few months after arrival. The natural experiment of refugee immigration around the year 2015 allows isolating a pure immigration-induced labor demand effect. To address the potential endogenous sorting of refugees into districts[1], the study employs an instrumental variable approach, using the availability of vacant military bases that were frequently used as provisional large-scale accommodations and administrative distribution quotas for refugees as instruments. The results are in line with predictions from a theoretical framework with non-homothetic demand, where an increasing share in the consumption of necessities is associated with rising demand of labor-intensive goods: As the number of recently arrived refugees and thus the demand for locally produced goods increases, local employment grows particularly in non-tradable sectors. Specifically, 2.4 new refugees increase local employment by one additional job. At the same time, unemployment drops while individual wages do not change significantly which can be traced back to widespread labor market rigidities in Germany. The sectors that experience the largest employment gains from the demand by recently arrived refugees are administration and temporary agency work. Additionally, women and new labor market entrants disproportionately benefit from new employment opportunities. However, the positive demand effects of refugee immigration are relatively short-lived, disappearing after three years as refugees start taking up jobs and require less integration support. Overall, the study contributes to the literature by isolating the labor demand effects of immigration and providing a more comprehensive understanding of how immigration affects labor markets.

[1] "Kreise und kreisfreie Städte"

Chapter 2 (joint work with Sebastian T. Braun and Richard Franke). The second chapter shows that 19th-century industrialization is an important determinant of the significant *changes* in Germany's economic geography observed in recent decades. Using novel data on economic activity in 163 labor market regions in West Germany, it establishes that nearly half of them experienced a reversal of fortune between 1926 and 2019, i.e., they moved from the lower to the upper median of the income distribution or vice versa. Economic decline is concentrated in North Germany, economic ascent in the South. One important finding of the study is that 19th-century industrialization plays a significant role in these changes. The study shows that early industrialization, which was once an advantage for economic development, has turned into a burden. To establish causality, the study instruments a region's industrial employment share in 1882 by its weighted least-cost distance to European coalfields. The 2SLS estimates suggest that a one standard deviation increase in the 1882 industry employment share increases a labor market's rank in the income distribution by 16.8 percentiles in 1957, but decreases the rank by 14.3 percentiles in 2019. In contrast to previous evidence, the study finds that early industrialization is not associated with lower levels of human capital in Germany. Instead, it appears that early industrialization became a drag on economic development because of its negative impact on local innovation and adaptive capacity. Especially, the dominant position of large-scale corporations in heavy industry, embedded in a supportive system of corporate relations, preserved local economic structures in an early phase of decline. The study also quantifies the contribution of regional differences in 19th-century industrialization to the current North-South gap in per capita income. The estimates suggest that regional differences in early industrialization can account for almost half of the current North-South gap in per capita income. Additionally, the study finds that the declining positive impact of early industrialization explains well over half of the decline in regional inequality from 1957 to 1980. These findings illustrate that the interpretation of contemporary changes in regional inequality, which have received much attention recently, require careful consideration of the past.

Chapter 3 (joint work with Jan Stuhler). Using all available waves from the *microcensus*, this chapter provides a comprehensive review of their labor market integration over the last 50 years. The large sample size and time horizon allow to track the labor market outcomes of very specific immigrant cohorts over many decades. The descriptive patterns are in stark contrast to the US literature: While the employment gaps between male immigrants and natives decline in the first years after arrival, they do not close fully and remain substantial, amounting to an average 10 percentage points 10 years after arrival and with substantial variation between origin cohorts. Income gaps are instead *widening* with time spent in Germany. These gaps in employment and income decrease in the second generation, but do not close fully. While income gaps shrink by more than 70%, the employment gaps remain large – in particular for those cohorts that already struggled most in the first generation. Exploring how *predictable* integration profiles are, the

study shows that *cohort*-level characteristics, i.e. the average characteristics of all migrants from a given cohort are predictive of *individual* trajectories and that variation in integration outcomes can be explained by a small set of cohort characteristics set around arrival (in particular educational level and the refugee share). Differences in integration outcomes between immigrant groups are therefore highly predictable. The study also tests whether integration has improved or worsened over the past five decades. The raw employment gap 10 year after arrival has widened substantially – by more than 15 percentage points over five decades. However, this systematic worsening can be fully explained by compositional changes and changing economic conditions. Accounting for these factors, the integration of newly arrived cohorts has remained broadly stable over the last 50 years. Also economic conditions do matter for the integration of migrants, and a series of structural shocks that hit the German labor market in the early 1990s triggered a dramatic collapse of employment among earlier arrivals. Finally, the study predicts the likely integration path of recent arrivals after the European refugee "crisis" and the 2022 Russo-Ukrainian war. In summary, Chapter 3 offers a long-term perspective on Germany's experience as an immigration country, highlighting key challenges and documenting important differences to the US case.

Chapter 4 The final chapter of this dissertation studies how new immigration and structural transformations impact the integration of established migrants, using the example of Turkish migrants after the collapse of the Iron Curtain. Thanks to unique panel data from pension accounts that starts in 1951, this study can track the cohort of so-called "guest workers" who were recruited by German firms during the 1960s and 1970s over their entire careers in Germany. A descriptive analysis reveals that older Turkish migrants experienced a sharp decline in employment rates and rise in unemployment in the early 1990s compared to native workers, while younger Turkish cohorts experienced a smaller decline in relative employment but also a widening of wage gaps. The labor market outcomes of migrants from other recruitment states did not change. The study estimates the differential effects of various economic shocks and changing conditions during the 1990s on Turkish migrants and natives, including new immigration from East Germany and Central and Eastern Europe, the employment drop during the 1993 recession, and task-biased technical change. The empirical analysis is based on individual fixed effects models and Oaxaca-Blinder decompositions. To establish causality and account for the potential endogeneity of immigrant inflows recession shocks, shift-share predictions and proximity to the inner German border are used as instrumental variables. The results show that almost the entire employment drop for recruited Turks can be explained by the decline in low-skilled manual employment following the 1993 recession. Younger Turkish cohorts were also particularly sensitive to new immigration. Finally, the study discusses potential explanations for the higher sensitivity of Turkish immigrants to economic changes compared to other migrants. It suggests that the tendency of Turkish migrants to remain in Germany and rely on welfare benefits after becoming unemployed may account for up to one third of the widening gaps in labor market outcomes between

Turkish and other migrants who were more likely to return home when losing their jobs. More generally, Chapter 4 examines the complex interplay of migration, integration and structural change and highlights important labor market challenges for older migrants.

Chapter 1

The Labor Demand Effects of Refugee Immigration

Joint work with Herbert Brücker, Alfred Garloff, and Katrin Sommerfeld

Slightly modified versions of this chapter have been circulated as discussion papers under the title "The Labor Demand Effects of Refugee Immigration: Evidence from a Natural Experiment" (Berbée, Brücker, Garloff & Sommerfeld, 2022a,b).

My individual contribution within the coauthors' team includes: Conceptualization; Methodology (identification strategy and empirical model); Software; Validation; Formal Analysis; Investigation (data collection); Data curation; Writing – Original Draft; Visualization. (Contributor Role Taxonomy, CRediT, see Brand, Allen, Altman, Hlava & Scott, 2015)

1.1 Introduction

How does immigration affect natives' employment and wages? While the labor supply effects from immigration on local labor markets have been extensively studied (and empirically isolated by Dustmann et al., 2017 and Beerli et al., 2021), labor demand effects from immigration have not been a focus of academic and public debate. Nonetheless, such labor demand effects have the potential to affect the wages or employment of domestic workers substantially (Bodvarsson et al., 2008; Borjas, 2013) and to partly counteract potentially negative labor supply effects. Usually it is empirically impossible to isolate labor demand effects from immigration, because they occur at the same time as supply shocks. We fill this gap by exploiting a natural experiment of refugees to Germany who are banned from working for the first few months after their arrival.

Germany was the largest receiving country in absolute terms from the sharp and unexpected surge in the influx of refugees to Europe in the years 2015 and 2016. In these two years, 1.3 million people newly applied for asylum in Germany, making up more than 1.6% of the resident population (BAMF, 2017). Asylum seekers[1] were strictly banned from working in the initial phase after arrival. Moreover, they were dispersed administratively across German regions and municipalities and forced to stay there by a residential obligation. Private consumption of the asylum seeker population was close to subsistence level and subject to administrative allocation. It consisted mainly of necessities such as housing, food and other subsistence goods. Moreover, public services accounted for a high share in expenditures per refugee. This implied that the consumption basket of the refugee population consisted of a disproportionally large share of locally provided non-tradable goods and services compared to that of natives.

We base our analysis of the demand effects from refugee immigration on a theoretical framework with non-homothetic demand, where the share of luxury goods in consumption relative to necessities increases with income and with rising earnings inequality. Empirical evidence for Germany shows that the share of tradable goods in private consumption monotonically increases with income level (Statistisches Bundesamt, 2021b). Given that non-tradable goods and services are labor intensive, the relatively low income level of the refugee population means that local labor demand tends to increase, an effect that is reinforced by public service expenditures for asylum seekers. In a setting with rigid labor markets, the demand shift towards non-tradables can increase employment rather than wages. The effect fades out in the medium run when immigrants' consumption structure converges to that of natives, when immigrants take up employment, or when the capital stock adjusts. The outlined mechanism holds irrespective of deficit spending in the economy but hinges, instead, on the different consumption structure of poor relative to rich households in general, and the specific consumption patterns of refugees compared with natives in particular. The insights from the model have generalizable implications, since consumption patterns of immigrants are expected to differ systematically from that

[1] We refer to "asylum seekers" for all immigrants who initially filed an asylum application, regardless whether the application is later approved.

of natives, depending on their income levels and on the impact of immigration on the dispersion of earnings.

For the empirical identification of the demand effects we exploit a natural experiment that created regional variation in the number of refugees subject to an employment ban. Refugees have been dispersed in Germany according to local and regional government quotas. Despite these administrative dispersal policies, some endogenous sorting of refugees remained, which potentially threatens the empirical identification of the local labor-market effects of the refugee influx. To address this, we use two instruments for the actual allocation of refugees: the availability of vacant military bases that were frequently used as provisional large-scale accommodations as well as administrative quotas from the dispersal policy. Unlike actual refugee arrivals, both instruments are uncorrelated with local labor market trends prior to the immigration shock.

The empirical results corroborate our theoretical expectations: the influx of asylum seekers subject to an employment ban induces significant additional short-term regional employment growth, which is fully driven by non-tradable service sectors, especially those in public administration and in temporary agency work. One newly arrived asylum seeker increases local employment by 0.42 in the short run. Put differently, 2.4 additional refugees increase local employment by one job. At the same time, the tradable sector shows no discernible employment effects. The effects on wages are small and not statistically significant in the short run, which is in line with the theoretical predictions in a setting with imperfect labor markets and rigid wages. In line with the strong employment effects at the local level, unemployment decreases substantially, corresponding to 55% of the magnitude of the observed employment gains. Unemployment reductions are disproportionally large for low skilled workers and for foreigners from non-refugee countries. When considering the mid-term persistence of the effects two years after the onset of the considered inflow of refugees, only about 20% of the original impact on employment growth remains, which we attribute to gradual employment take-up and the relocation of refugees.

The contribution of this paper to the literature on the labor-market effects of immigration is fourfold. First and foremost, we isolate the impact of immigration on local labor demand by exploiting the natural experiment of an employment ban. This is a novelty in the immigration literature, which usually analyzes immigration as a supply shock. The demand effects resulting from shifts in consumption patterns are either ruled out in structural models employing one-good production functions[2] or are only implicitly considered in reduced-form regressions.[3] In contrast to this literature, empirical evidence regarding the effects of immigration on labor demand is scant. A small set of empirical studies finds that (positive) consumer demand effects can be substantial and thus can offset the (negative) labor substitution effects from immigration (Bodvarsson & Van den Berg, 2006; Bodvarsson et al., 2008; Hong & McLaren, 2015; Cengiz & Tekgüç,

[2] Borjas (2003), Brücker, Hauptmann, Jahn & Upward (2014), Dustmann, Frattini & Preston (2013) and Ottaviano & Peri (2012).

[3] Greenwood & Hunt (1984), Card (1990), Pischke & Velling (1997), Card (2005). The reviews of the literature provided by Friedberg & Hunt (1995) and Lewis & Peri (2015) are likewise agnostic on the demand effects.

2021). However, these studies are unable to fully rule out simultaneous labor supply effects from immigration. We attribute the problems in the empirical identification of the impact of demand effects to a lack of suitable setups and data.

This paper complements the literature that isolates labor supply shocks from immigration based on cross-border commuting (Dustmann et al., 2017; Beerli et al., 2021) and that suggests that labor demand effects from immigration are due to skill complementarities (*ibid.*). We abstain from analysis of this type of labor demand effect, focusing instead on consumption-induced labor demand effects.

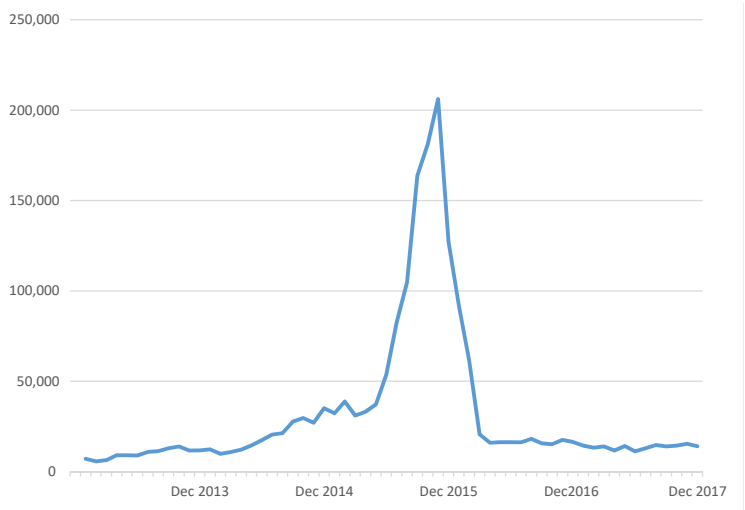
Second, we present a novel framework for analyzing the labor-market effects based on non-homothetic demand. This framework allows us to analyze the different demand patterns of immigrants and natives and their labor market implications in a systematic manner by considering the fact that the composition of demand depends on income levels. This distinguishes our model from previous approaches such as Borjas (2013), which derives the demand effect from a trade model with complete specialization, or Bodvarsson et al. (2008), where the demand effects depend on whether immigrants consume disproportionally more or fewer goods from the sectors in which they are employed. In both cases the outcomes depend on preferences of the immigrant population, which may differ in one way or another from those of natives.

Third, our findings also contribute to the debate on the economic effects of hosting refugees. We argue that beyond the general migration literature, the demand side is particularly important to fully understand the effects of humanitarian immigration, because refugees tend to need more time to pick up employment and are often confronted with employment bans (Dustmann, Fasani, Frattini, Minale & Schönberg, 2017; Brell, Dustmann & Preston, 2020; Fasani, Frattini & Minale, 2021a). Nevertheless, the rapidly growing literature on the effects of refugee immigration on host countries' labor markets has focused on labor supply (e.g. Tumen, 2016, Borjas & Monras, 2017, Ceritoglu, Yunculer, Torun & Tumen, 2017, Fallah, Krafft & Wahba, 2019). The paper by Cengiz & Tekgüç (2021) is an exception as it documents additional labor demand from refugee immigration and shows native-migrant labor complementarities within the group of low-skilled individuals. We show that while refugees might compete for jobs, they also stimulate the local economy and create additional employment opportunities for the resident population through the goods and services they consume.

Finally, we add to the literature that exploits natural experiments for estimating causal effects of immigration by developing a novel identification strategy. While dispersal policies have been used before to instrument the allocation of refugees (Glitz, 2012; Foged & Peri, 2016), we show how in the setting of the so-called European Refugee Crisis of 2015—2016 some endogenous regional sorting remains.[4] We therefore suggest a novel instrument: vacant military compounds. We argue that military rather than economic considerations have determined the vacancy of military compounds and show statistically insignificant pre-trends with respect to local economic conditions. As a second,

[4] For that reason, Steinmayr (2020) uses the availability of group accommodations to instrument the distribution of asylum seekers in Upper Austria.

FIGURE 1.1: MONTHLY REGISTRATIONS OF ASYLUM SEEKERS IN GERMANY



Source: Adapted from the registrations in the "EASY" system from the Federal Office for Migration and Refugees (BAMF).

complementary instrumental variable we use the administrative allocation quotas. By providing these new instruments for the spatial distribution of recently arrived asylum seekers in Germany, we advance the empirical literature and open up new research.

This paper proceeds as follows. The next section outlines the institutional background including potentially endogenous deviations from the dispersal policy. Building on this, Section 1.3 presents the theoretical framework for our analysis. Section 1.4 lays out the empirical model and explains the identification strategy. Section 1.5 describes the data. The empirical results are presented in Section 1.6. Section 1.7 concludes.

1.2 Institutional Background

1.2.1 Dispersal Policy

From June 2015 to February 2016, an unexpectedly large number of asylum seekers arrived in Germany (Figure 1.1). The government assigned the asylum seekers to regions using a dispersal policy based on quotas and we use the quotas for our identification strategy (Appendix 1.A.2 for details on the calculation of the quotas).

Although the distribution quotas can be influenced neither by local authorities nor by refugees themselves, anecdotal and empirical evidence suggests that during the peak of the immigration episode, substantial deviations from the dispersal policy occurred (Appendix 1.A.3 for more details). In particular, local authorities were overwhelmed by the sheer number of arrivals and had to make pragmatic decisions to avoid homelessness. Accordingly, they sent new incomers to places where housing was still available. Publicly owned property played a very important role for creating provisional housing

because it was available at very short notice. About 480 different properties[5] with a total capacity for about 155,000 persons[6] were provided by federal authorities, and probably many more were in the ownership of states and municipalities themselves. An important share of the federal properties that were used to house asylum seekers consists of unused military bases that had been abandoned by German or foreign armed forces. These were frequently transformed into group accommodations, some of which could house up to several thousand people.[7] Especially when it came to locations for new Initial Reception Facilities (IRF) where asylum claims were submitted and processed, military bases had the advantage that buildings suitable for housing many people (e.g. with sanitary facilities) and office space were usually already in place. In the state of Baden-Württemberg, for instance, about 78% of asylum seekers living in IRFs in 2015 were hosted in previous military compounds.

Table 1.1 shows that endogenous deviations from the official distribution mechanisms occurred by showing a disproportional (actual) placement of recently arrived asylum seekers into rural regions, regions with high unemployment rates and regions that possess a vacant military base. Vacant housing in the private market did not play a major role. Columns (2) and (3) suggest that our instruments do not correlate with these regional characteristics.

1.2.2 Employment and Mobility Restrictions for Asylum Seekers

In order to isolate a potential labor demand effect from immigration, we focus on immigrants who are banned from working. This restriction concerns asylum seekers within the first three months of their stay in Germany and those who are obliged to live in an IRF (up to 18 months, or as long as the asylum procedure lasts for refugees from certain "safe" countries). Importantly, the same group of asylum seekers that is subject to an absolute employment ban also faces a strict rule not allowing them to change their place of residence ("residence obligation").[8] Therefore, when studying the labor-market effects of asylum seekers that are not allowed to work themselves, the legal setting does not allow for any self-selection of immigrants into regions, neither at arrival nor after. Our instruments can account for resulting biases in the case of deviations from the dispersal policy.

1.2.3 Benefits and Support for Asylum Seekers

Asylum seekers in Germany receive social benefits as well as publicly provided support. They receive specific social benefits which include housing, food and other daily needs

[5] As of mid-2016—the list was retrieved from the Federal Institute for Real Estate. See Section 1.5.

[6] These figures are from the year 2017. Data from the Federal Ministry of Finance.

[7] This is true in Bad Fallingbostel, Heidelberg and in many other cases. In Baden-Württemberg in late 2015, 10 out of 40 IRFs hosted more than 1000 asylum seekers.

[8] Asylum seekers lose entitlements to benefits when violating this obligation. They may only move if they can afford their own living expenses. If they move to another place without permission of the authorities in charge, they can be subject to enforcement measures and even imprisonment.

TABLE 1.1: ENDOGENEITY OF REFUGEE DISTRIBUTION

	(1) $\Delta AS/pop$	(2) IV: Military Base	(3) IV:Quotas
Unemployment rate (one-year lag)	3.79**	-0.43	0.01
	(1.47)	(0.66)	(0.71)
Real GDP pc (one-year lag)	1.73	0.24	0.12
	(1.08)	(0.20)	(0.11)
Rural region (dummy)	21.97**	-4.50	-6.64
	(10.49)	(4.34)	(5.68)
Foreigner share (one-year lag)	-2.40	-0.81	-1.46
	(1.63)	(0.70)	(0.96)
Percentage vacant housing (one-year lag)	-2.31	-0.82	-1.31
	(2.07)	(0.78)	(1.06)
Vacant military base (dummy)	35.71**		-0.34
	(14.93)		(3.28)
Observations	2,639	2,639	2,639

Notes: The table shows OLS regressions with the per-capita inflow of asylum seekers without labor market access (column 1), military bases interacted with a dummy for the peak of refugee immigration in 2015h2-2016h2 (column 2) and the predicted per capita inflow based on distribution quotas and EASY assignments (column 3) as dependent variables. All dependent variables are measured in percentage points. All regressions cover the period 2014-2017 and include time fixed effects. All estimations are weighted with the population in base year 2013, excluding refugees. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

as well as basic health insurance.[9] The total benefits paid to an asylum seeker during the first year of stay amount to 4,368 euros, of which a large part is paid in-kind rather than in cash. This holds in particular for asylum seekers living in centralized group accommodations, i.e the group we focus on. On top of these benefits, further expenses occur as public authorities provide different types of services to asylum seekers. The total amount of public spending is estimated to lie between 10,000 and 15,000 Euro per asylum seeker per year (Czerny, 2018)[10], which is about double to threefold the social benefit expenses. Thus, consumption of the refugee population was largely characterized by an administrative allocation of publicly provided services such as centralized collective housing, integration and labor market programs, education, security services, etc., which required substantial administrative effort. Most of these services are labor intensive and need to be

[9] According to the Asylum Seekers Benefits Act ("Asylbewerberleistungsgesetz"), this applies during the first 15 months after arrival in Germany or until their asylum application has been accepted. Since March 2016, the monthly rate to cover basic needs is 219 euros for a single adult. This rate excludes rent and health insurance and differs for couples and children (§17(2) AsylbLG). In addition to these basic needs, asylum seekers also receive transfers for "other necessary personal needs" of nearly 150 euros that are usually paid in cash, even to those living in shared accommodation (§17(1) AsylbLG).

[10] In 2014, lump-sum refunds per asylum seeker per year varied across federal states and lay between 6,000 and 9,000 euros. For the years 2013—2015, Czerny (2018) estimates annual local government spending from municipal budgets to average 13,700 euros per asylum seeker. Across Germany as a whole in 2016, 9.26 billion euros were reimbursed to the districts and municipalities by the central government. This translates into reimbursements of roughly 10,000 euros per asylum seeker per year. For more details, see Appendix 1.A.4.

provided locally (such as staff for administration, security, housing and integration programs) and several require specially trained personnel such as trained decision makers, case workers, social workers, translators, psychologists and other administrative staff. These services are provided predominantly by the public sector—potentially with the help of temporary agency workers—which is where we expect to find the largest effects.

1.3 Theoretical Background

In this section we present a theoretical model that analyzes the mechanisms by which an immigration-induced demand-shift towards non-tradable goods and services increases local labor demand. The theoretical framework is based on a non-homothetic demand system that relies on the fundamental assumption that the consumption share of necessities compared with luxury goods declines with income level. This framework follows the tradition of the "Price Independent Generalized Linearity (PIGL)" preferences (Muellbauer, 1975, 1976) and the "Almost Ideal Demand System (AIDS)" by Deaton & Muellbauer (1980), which ensure the aggregation of individual preferences but are more general than homothetic or quasi-homothetic demand systems fulfilling the criteria of Gorman's polar form. Since preferences are non-homothetic, the aggregate demand of necessities and luxury goods depend in mean income and the dispersion of income in the economy in our specification of the demand system.

The model builds on the assumption that poor households consume a disproportionally high share of necessities. Empirical evidence suggests in turn that necessities consist of a disproportionally high share of non-tradable goods: the share of tradables in private consumption tends to increase with the income level. We demonstrate this by exploiting the German Income and Consumption Survey (Statistisches Bundesamt, 2021b) (Table 1.2). While expenditure shares for housing are particularly high for poor households, rich households tend to spend higher shares for transport equipment, consumer electronics, and leisure and entertainment equipment. On top of that, as the previous section has demonstrated, public spending for refugees is disproportionally high, such as for education, labor market and integration programs, which also have to be administered publicly. Those programs consist almost entirely of non-tradable services.

In a nutshell, the immigration of refugees involves a shift in relative demand towards non-tradable goods and services. This in turn increases labor demand since non-tradables are produced more intensively than tradable goods in local labor markets (Appendix Table 1.A1). As a consequence, the demand shift towards non-tradables tends to increase wages, and, if labor markets are characterized by wage rigidities, raises employment.

In this section we capture these mechanisms in a stylized model with two goods, non-tradables and tradables, and two factors of production, labor and capital. The heterogeneity of the labor force is captured by differences in individual labor productivity, which is assumed to be exogeneously distributed across the employed workforce and can differ between native and migrant workers. To simplify issues, we also assume that

TABLE 1.2: PRIVATE CONSUMPTION OF TRADABLES AND NON-TRADABLES BY INCOME LEVEL IN GERMANY, 2020 (%)

	Household income in EUROs					
	< 1,300	1,300-1,700	1,700-2,600	2,600-3,600	3,600-5,000	> 5,000
Tradable goods and services[1]	**36.7**	**41.5**	**42.2**	**42.9**	**45.1**	**48.0**
of these:						
Food and clothing	21.8	21.5	20.3	19.8	19.4	17.6
Transport equipment, fuels	2.0	6.6	6.9	7.6	9.4	11.3
Consumer electronics, sport, leisure and entertainment equipment	4.7	5.9	6.4	6.9	7.6	9.4
Furniture, household equipment	4.5	4.2	4.7	4.6	5.3	6.2
Non-tradable goods and services[2]	**63.3**	**58.5**	**57.8**	**57.1**	**54.9**	**52.0**
of these:						
Housing incl. incidental costs	49.7	43.3	41.2	39.5	36.9	31.5
Restaurants and hotels	2.4	2.9	3.2	3.8	4.5	4.7
Transport services	3.0	3.3	3.6	3.8	3.5	4.7
Telecommunication services	3.5	3.4	3.0	2.7	2.2	1.8
Number of observations	773	604	1,457	1,391	1389	1,899

Notes: 1) Food, beverages, tobacco, clothing and shoes (w/o repair), interior, household goods (w/o services), health goods, cars and vehicles (w/o repair), fuels, phones and communication equipment, consumer electronics, photo equipment, sport equipment etc., jewelery, watches, body care equipment, etc.– 2) Housing incl. incidental costs, household services, health services, repairs of transport equipment, transport services, postal and telecommunication services, leisure and cultural services, educational services, body care services. The findings are based on the "Einkommens- und Verbrauchsstichprobe" in Germany, a survey of 7,513 households that allows representative inferences on the population residing in Germany.

the labor force participation rate is exogenous and may vary between natives and migrants. The empirically relevant case of an employment ban is modeled by setting the labor force participation rate for migrants to zero. Furthermore, in order to capture the labor demand effects of migration, we employ a simple wage-setting framework where wages respond imperfectly to changes in the unemployment rate. Non-employed households receive a benefit which equals a fraction of mean total income (including capital income) and is funded by a uniform tax rate on all sorts of income. As a consequence of the non-homethetic demand framework, migration can affect wages and the employment of natives even if refugees are banned from working, since the tax-transfer system affects mean income and the dispersion of earnings in the economy. The framework is comparative-static and rules out savings. The budget constraint also implies that transfers to the non-employed are entirely funded by the tax system.

Our framework addresses the labor market impact of a demand shift under the assumption of a balanced budget. An alternative way to address the demand effects of refugee migration would be to employ a neo-Keynesian framework with sticky prices on goods and factor markets at the macro level. In this setting, public transfers to refugees might temporarily increase labor demand if there is deficit spending, i.e. if additional expenditures are funded neither by higher taxes nor by social security contributions and if Ricardian equivalence does not hold. We acknowledge that such effects may play a role

but we do not require them, i.e. the mechanisms of our model work even in the absence of deficit spending. Moreover, the mechanisms we outline here, can be generally applied to the labor market effects of migration, i.e. when demand and supply effects occur simultaneously and for all cases where immigrants' income differ from that of natives. We can also capture long-term effects of migration when possible Keynesian demand effects have disappeared.

The novelty of the approach is that we start from the observation that the composition of demand varies with the income level which allows addressing the effects of migration in a systematic manner. This distinguishes our framework from other approaches relying on homothetic- or quasi-homethetic demand systems, such as those of Borjas (2013) and Bodvarsson & Van den Berg (2006). There, the labor demand effects of migration depend on the assumption that the preferences of migrants differ from those of natives, e.g. that they consume a higher share of goods produced in foreign countries compared with natives (Borjas, 2013) or that they tend to consume more goods from sectors in which they are employed (Bodvarsson & Van den Berg, 2006). By contrast, we do not need to make assumptions on differences in preferences.

1.3.1 Demand

We follow Boppart (2014)[11] and write the indirect utility function as

$$V(X_N, X_T, e_h) = \frac{1}{\epsilon}\left(\frac{e_h}{p_T}\right)^{\epsilon} - \frac{\beta}{\gamma}\left(\frac{p_N}{p_T}\right)^{\gamma} - \frac{1}{\epsilon} + \frac{\beta}{\gamma}, \tag{1.1}$$

where $V(\cdot)$ is the indirect utility function. There is a continuum of households of size H, where $H = N + M$ and N are natives and M migrants, indexed by h over the interval $[0\ H]$. X_j for $j = N, T$ denotes non-tradable and tradable goods, respectively; e_h income of household h, p_j for $j = N, T$ the price of non-tradable and tradable goods, respectively; ϵ and γ are parameters determining the price and income elasticities and β is constant.[12]

As shown in Appendix 1.M.1, we can derive from the indirect utility function in equation (1.1) the aggregate demand system as

$$d\ln\left(\frac{X_N}{X_T}\right) = -\sigma_D d\ln\left(\frac{p_N}{p_T}\right) - \frac{\epsilon}{\theta_T} d\ln\bar{e} + \frac{1}{\theta_T} d\ln\psi, \tag{1.2}$$

where $\theta_T \equiv \frac{p_T X_T}{p_N X_N + p_T X_T}$ is the expenditure share of tradable goods in total expenditures and $\bar{e}$ is mean income. The aggregate price elasticity of substitution, σ_D, is given by

$$\sigma_D = 1 - \gamma - (\gamma - \epsilon)\frac{\beta\left(\frac{p_N}{p_T}\right)^{\gamma}}{\left(\frac{\bar{e}\ \psi^{-1/\epsilon}}{p_T}\right)^{\epsilon} - \beta\left(\frac{p_N}{p_T}\right)^{\gamma}}, \tag{1.3}$$

[11] See Egger & Habermeyer (2022) for an application of this indirect utility function in the trade context.

[12] The functional form in equation (1) is well behaved if $0 \leq \epsilon \leq \gamma \leq 1$ and a valid specification of the indirect utility function if and only if $e_h^{\epsilon} \geq \frac{1-\epsilon}{1-\gamma}\ \beta p_N^{\gamma} p_T^{\epsilon-\gamma}$ (Boppart, 2014). We assume throughout the paper that these conditions are fulfilled.

which depends on average income and an inequality index since demand is non-homothetic. The inverse inequality index ψ is given by $\psi = \int_0^{(} H) \left(\frac{e_h}{\bar{e}}\right)^{1-\epsilon} dh$. It is scale-invariant and defined over the interval [0 1]. The index depends on the distribution of income and thus on individual labor productivity, the employment share and the redistribution of income via the tax-transfer system as shown below.

The consumption of non-tradables (necessities) relative to tradables (luxury goods) increases if (i) the relative price of non-tradables falls, (ii) mean income declines, or (iii) the distribution of income becomes more egalitarian. The last point results from the fact that the expenditure share of the poor tends to increase if the distribution of income is more equal. These results apply only if demand is non-homothetic, i.e. if $\epsilon > 0$. In the limiting case of homothetic demand, i.e. if $\epsilon \to 0$, mean income and the income dispersion no longer affect the relative demand of tradable and non-tradable goods.[13]

1.3.2 Production

The production side of the economy is characterized as follows and is similar to Jones (1965) and Rivera-Batiz (1982, 1983). There are two sectors, one producing a non-tradable good and the other producing a tradable good, and both are based on two factors of production, labor and capital. To keep the framework simple, we assume that production is characterized by constant returns to scale and that profit-maximizing firms operate in an environment with perfect competition. Thus, firms are price-takers in goods and factor markets. We also employ the small country assumption implying that the price of the composite tradable good is determined by international markets and will remain constant.[14] Finally, we assume that the non-tradable sector is labor intensive which is a well-established stylized fact in the empirical literature and illustrated for Germany by table B.1 in the appendix.

We capture the heterogeneity of labor by differences in labor productivity, such that the effective labor input of households, $\tilde{L}$, is given by $\tilde{L} = L \int_{\underline{\alpha}}^{\bar{\alpha}} \alpha \; \ell(\alpha) \; d\alpha = \tilde{\alpha} L$ where α denotes individual labor productivity continuously distributed over the interval $[\underline{\alpha} \; \bar{\alpha}]$, $\ell(\alpha)$ the density function of effective labor supplies, $\tilde{\alpha}$ the average labor productivity in the economy and $\tilde{L}$ the total labor input in efficiency units. The labor force participation rate for natives and migrants is assumed to be exogenous, but may differ between natives and migrants. Thus L/H may vary with the size of M. We consider below the limiting case of an employment ban for refugees, i.e. where the labor force participation rate of migrants is zero.

As outlined in Appendix 1.M.2, the assumptions on production technologies and the equilibrium conditions in goods and factor markets for the change of the log wage with

[13] Note that if $\epsilon = 0$ the inverse inequality index ψ is constant.

[14] Note that in a framework with three goods - one non-tradable and two tradables that differ in their factor intensity - factor price equalization holds such that neither changes in factor endowments nor in the composition of consumption affects factor prices or, in a setting with imperfect labor markets, employment opportunities. We rule out this possibility here.

respect to migration allow us to derive the following:

$$\frac{d\ln w}{d\ln M} = -\frac{1}{\sigma}\frac{d\ln(\tilde{L}/K)}{d\ln M} - \epsilon\frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\frac{d\ln\bar{e}}{d\ln M} + \frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\frac{d\ln\psi}{d\ln M}, \tag{1.4}$$

where w denotes the wage rate per efficiency unit of labor in terms of the price of the tradable good, M the amount of migrant households and K the capital stock. Note that the wage rate equals the marginal product of labor. The composite elasticity of substitution σ is the weighted sum of the elasticity of substitution on the demand-side and on the supply-side, where the demand-side elasticity is determined by equation (3) and the supply-side elasticity by the parameters of the model. More specifically, σ is defined as $\sigma \equiv \frac{|\theta||\lambda|(\sigma_D+\sigma_S)}{\theta_{KT}}$, where $|\theta|$ denotes the determinant of factor income shares, θ_{ij}, where e.g. $\theta_{\tilde{L}N} \equiv \frac{w\tilde{L}_N}{p_N X_N}$; and $|\lambda|$ denotes the determinant of the factor input shares, λ_{ij}, which is defined as the share of factor input i in sector j in the total input of factor i in the economy. Both determinants are positive given the assumption that the production of non-tradables is labor-intensive. The elasticity of substitution on the supply side, σ_S, is defined as $\sigma_S \equiv \frac{1}{|\lambda||\theta|}(\varepsilon_{\tilde{L}} + \varepsilon_K)$, where $\varepsilon_{\tilde{L}}$ denotes the elasticity of changes in labor intensity with respect to wage changes and ε_K denotes the elasticity of changes in the capital intensity with respect to changes in the rental rate of capital at constant output. Finally, θ_{KT} denotes the factor income share of capital in the tradable sector (see Appendix 1.M.2 for details).

Equation (1.4) delivers the main results of the model. First, we obtain the expected result that the wage rate is declining if the capital endowment per efficiency unit of labor in the economy falls due to migration. Second, the wage rate is increasing if migration triggers a decrease in mean household income –as is expected for refugees– since the consumption of non-tradables increases when average income levels decrease. Finally, a more egalitarian distribution of labor productivity unambiguously increases the wage level since higher earnings of the poor relative to the rich tend to increase the consumption of non-tradables. The latter two effects capture the effects of a demand shift through migration.

Consider the limiting case of an employment ban (on refugees) such that the labor force participation of the migrant population is zero while that of the native population remains constant, i.e. that $\frac{d\ln L}{d\ln M} = 0$. In this case equation (1.4) simplifies to

$$\begin{aligned}\frac{d\ln w}{d\ln M} &= -\frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\left[\epsilon\frac{d\ln\bar{e}}{d\ln H} - \frac{d\ln\psi}{d\ln H}\right]\frac{d\ln H}{d\ln M}, \\ &= \frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\left[\frac{\frac{L}{H}\left[b^{1-\epsilon} - \psi_\alpha b\right] + \epsilon b\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}{\left[\frac{L}{H} + \left(1-\frac{L}{H}\right)b\right]\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}\right]\frac{d\ln H}{d\ln M} \geq 0,\end{aligned} \tag{1.5}$$

where we have decomposed average income, $d\ln\bar{e}$ and the inverse inequality index, $d\ln\psi$, into its components to achieve the results in the second line (see Appendix A.3). While this decomposition leaves $\bar{e}$ unaffected, the inverse inequality index depends on the exogeneous distribution of the labor productivity of the employed workforce, ψ_α, the labor force participation rate L/H and the transfer rate b.

The first term from equation (1.4) disappears in equation (1.5) since labor supply and average labor productivity remain constant if migrants cannot participate in the labor force. The remaining term is unambiguously positive if (i) demand is non-homothetic, i.e. if $\epsilon > 0$, and (ii) transfers exist, i.e. $b > 0$. The latter result is due to the fact that we assume zero demand effects of migration if they receive neither wages nor transfers. As a result, when immigrants do not work but receive some transfers, immigration unambiguously increases wages.

1.3.3 Imperfect Labor Markets and Employment Effects

So far we have assumed that labor markets are perfect, i.e. that a higher labor supply through immigration or a demand shift affects only wages but not employment. Building on Brücker & Jahn (2011) and Brücker et al. (2014) we now apply a wage-setting framework replacing the conventional labor supply curve with a wage-setting function to analyze the wage and employment effects of migration simultaneously. This wage-setting function relies on the assumption that wages decline with the unemployment rate, albeit imperfectly. This relationship is empirically widely supported, both at the macro level (Layard & Nickell, 1986; Nickell, Nunziata & Ochel, 2005) and at the regional level (Blanchflower & Oswald, 1994, 2005). Theoretically, the wage-setting function can be derived from right-to-manage models of collective bargaining (Nickell & Andrews, 1983) and efficiency wage theories derived from models with turnover cost (Salop, 1979) or shirking (Shapiro & Stiglitz, 1984). These models have in common the idea that the slope of the wage-setting curve depends on both the mark-up of the wage over the outside option of workers, and on the value of the outside option.

To capture the impact of a demand shift when refugees do not participate in the labor market, we distinguish labor force participation and unemployment. Define the labor force that participates in the labor market as $\hat{L} \leq H$, i.e. not all individuals or households participate in the labor market. We can write thus the unemployment rate as $u = 1 - \frac{L}{\hat{L}}$. As before, all non-employed households, i.e. both unemployed and non-participants in the labor force, receive unemployment benefits b, a fraction of mean income and these are entirely funded by the tax rate τ on income.

In the first stage of the decision process, firms and employees agree on wages as a function of the unemployment rate. Labor force participation does not affect the wage-setting function, however. This enables us to write the aggregate wage-setting equation as

$$w = \phi(u), \qquad \phi' \leq 1,$$

where ϕ is a function that captures the response of the wage to the unemployment rate. In a second step, given perfect competition on goods and factor markets, firms hire workers until the marginal product of labor equals the wage rate, i.e. $w = Y_L$. This allows us to equate the marginal product of labor with the wage-setting function ϕ and to solve for the employment response by differentiating this system implicitly (see Appendix 1.M.4). For the log change of employment with respect to a log change of the population through

migration this yields

$$\begin{aligned}\frac{d\ln L}{d\ln M} = &\left[\frac{1}{\sigma}\frac{d\ln\tilde{L}}{d\ln L} + \frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\left(\epsilon\frac{d\ln\bar{e}}{d\ln L} - \frac{d\ln\psi}{d\ln L}\right) + \mu\frac{\bar{L}}{L}\right]^{-1} \\ &\times\left[\frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\left(\frac{d\ln\psi}{d\ln H} - \epsilon\frac{d\ln\bar{e}}{d\ln H}\right) + \mu\frac{\bar{L}}{L}\frac{d\ln\bar{L}}{d\ln H}\right]\frac{d\ln H}{d\ln M},\end{aligned} \tag{1.6}$$

where $\mu \equiv -\frac{\partial\phi}{\partial u}\frac{1}{\phi}$ is the semi-elasticity between the wage and the unemployment rate. We can rewrite equation (1.6) by decomposing $\bar{e}$ and ψ into their components as

$$\begin{aligned}\frac{d\ln L}{d\ln M} = &\left[\frac{1}{\sigma}\left(1+\epsilon\frac{|\lambda|}{\theta_T}(1-\theta_{KT})\right)\frac{d\ln\tilde{L}}{d\ln L} - \frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\left(\omega + \xi\frac{d\ln\psi_\alpha}{d\ln L}\right) + \mu\frac{\bar{L}}{L}\right]^{-1} \\ &\times\left[\frac{1}{\sigma}\frac{|\lambda|}{\theta_T}(\epsilon-\omega) + \mu\frac{\bar{L}}{L}\frac{d\ln\bar{L}}{d\ln H}\right]\frac{d\ln H}{d\ln M},\end{aligned} \tag{1.7}$$

where ω is a short-cut for $\frac{L}{H}\frac{\psi_\alpha b - b^{1-\epsilon} + \epsilon[1-b]\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}{\left[\frac{L}{H} + \left(1-\frac{L}{H}\right)b\right]\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}$ and ξ is a short-cut for $\frac{\frac{L}{H}\psi_\alpha}{\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}}$. The term $\epsilon - \omega = \frac{\frac{L}{H}\left[b^{1-\epsilon} - \psi_\alpha b\right] + \epsilon b\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}{\left[\frac{L}{H} + \left(1-\frac{L}{H}\right)b\right]\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]} \geq 0$. This term is positive if demand is non-homothetic, i.e. $\epsilon > 0$ and if the transfer rate $b > 0$.

Equation (1.7) delivers the employment effects of the model. First, if the wage rate responds perfectly elastic to a change in the unemployment rate, i.e. if $\mu \to \infty$, $\frac{d\ln L}{d\ln M} \to \frac{d\ln\bar{L}}{d\ln H}\frac{d\ln H}{d\ln M}$, the percentage change of employment equals the percentage change of the labor force through migration. Second, if wages do not adjust to a change in the unemployment rate at all, i.e. if $\mu = 0$, there is only an employment effect if $\epsilon - \omega > 0$, i.e. if demand is non-homothetic and if there are transfers. In this case, employment tends to increase due to the demand-shift effect but less than the increase in the labor force. Third, in the intermediate cases, i.e. if $0 < \mu < \infty$ and if $\epsilon > 0$ and $b > 0$, the employment response to migration is positive but might be smaller than the increase in the labor force through migration. It tends to increase if (i) the wage elasticity with respect to the unemployment rate increases, (ii) $\epsilon - \omega$ tends to increase, which is the case if demand becomes more non-homothetic, and (iii) the equality in the distribution of the labor productivity, ψ_α, tends to rise. It tends to decline if labor supply measured in efficiency units tends to increase.

In the limiting case of an employment ban, i.e. if the labor force participation of migrants is zero, equation (1.7) simplifies to

$$\frac{d\ln L}{d\ln M} = \left[\mu\frac{L}{\bar{L}}\right]^{-1} \times \left[\frac{1}{\sigma}\frac{|\lambda|}{\theta_T}(\epsilon-\omega)\right]\frac{d\ln H}{d\ln M} \geq 0. \tag{1.8}$$

which is positive if $\epsilon - \omega > 0$ and if the elasticity of wages with respect to unemployment is not infinite. Thus, in the case of an employment ban, the demand effect of hosting migrants unambiguously triggers additional employment of natives if the demand of consumers is not homothetic and as long as wages do not completely adjust to labor demand changes.

1.3.4 Capital Stock Adjustment and Long-Term Effects

Following Ottaviano & Peri (2006) and Borjas (2013) we assume that capital stocks adjust to labor supply changes, or, more precisely, to the rental rate of capital. Suppose that the relationship between the interest rate and the inverse elasticity of capital supply is given by $r = K^{\frac{1}{\sigma_K}}$, where σ_K is the elasticity of the response of the capital stock with respect to a change of the interest rate. Using this and the fact that $d\ln r = -\frac{\theta_{LT}}{\theta_{KT}} d\ln w$ and that $\theta_{LT} = 1 - \theta_{KT}$ we can rewrite the wage equation (1.4) as

$$d\ln w = -\frac{\theta_{KT}}{\sigma + (1-\theta_{KT})\sigma_K}\left[\frac{d\ln \tilde{L}}{d\ln M} + \epsilon\frac{|\lambda|}{\theta_T}\frac{d\ln \bar{e}}{d\ln M} - \frac{|\lambda|}{\theta_T}\frac{d\ln \psi}{d\ln M}\right], \tag{1.9}$$

and, analogously, we can rewrite the employment equation (1.6) as

$$\begin{aligned}\frac{d\ln L}{d\ln M} = &\left[\frac{\theta_{KT}}{\sigma + (1-\theta_{KT})\sigma_K}\left(\frac{d\ln \tilde{L}}{d\ln L} + \epsilon\frac{|\lambda|}{\theta_T}\frac{d\ln \bar{e}}{d\ln L} - \frac{|\lambda|}{\theta_T}\frac{d\ln \psi}{d\ln L}\right) + \mu\frac{L}{\bar{L}}\right]^{-1} \\ &\times\left[\frac{\theta_{KT}}{\sigma + (1-\theta_{KT})\sigma_K}\left(\frac{|\lambda|}{\theta_T}\frac{d\ln \psi}{d\ln H} - \epsilon\frac{|\lambda|}{\theta_T}\frac{d\ln \bar{e}}{d\ln H}\right) + \mu\frac{L}{\bar{L}}\frac{d\ln \bar{L}}{d\ln H}\right]\frac{d\ln H}{d\ln M}.\end{aligned} \tag{1.10}$$

Thus, the wage and employment effects of migration disappear if $\sigma_K \to \infty$, i.e. if the capital stock adjusts completely to labor supply and demand changes in consumption. We consider this to be the long-term effect.

1.3.5 Conclusions for the Empirical Investigation

From these theoretical considerations we conclude the following four results. First, in the short run, the non-homothetic demand framework predicts that an increase of households with low income through refugee migration involves a demand shift towards the consumption of necessities, which cover a disproportionally high share of non-tradable goods and services that are labor intensive. Second, in case of an employment ban, this demand shift translates either into higher wages or –if there are wage rigidities– into higher employment rates of natives, or both. Given that the institutional framework in Germany has a high coverage of collective bargaining, it is likely that changing consumption patterns affect employment in particular and that the wage effects are rather moderate. Third, when the employment ban is lifted, refugee migration displays both labor demand and labor supply effects. The labor supply effects are mitigated due to the lower labor productivity of the immigrant population, which reduces average income and, hence, increases the consumption of non-tradables relative to tradables, and, hence, employment or wages. The visible effects at the aggregate level are ambiguous, given that even when the employment ban is lifted, the labor market participation and employment rates of the refugee population are rather low to start. Fourth, in the long run, we expect that most effects disappear, since the capital stock adjusts to the changing demand and labor supply conditions.

1.4 Empirical Approach

1.4.1 Empirical Model

We estimate the labor demand effect of immigration on labor market outcomes of the local population. For that purpose, we focus on the regional inflow of only those asylum seekers who are subject to a strict employment ban. We start from the following regression model:

$$y_{dt} = \alpha + \beta \times m_{dt} + \delta_d + \delta_s + \pi_t + (\delta_d \times \pi_t) + (\delta_s \times \delta_t) + \epsilon_{dt}, \tag{1.11}$$

where y_{dt}, covers three different outcome variables: the aggregate employment rate in a district, L_{dt}/POP_{d0}; the employment rate in a specific sector and district, L_{jdt}/POP_{d0}; and the unemployment rate in a district, U_{dt}/POP_{d0}. These are all normalized by the local population, POP_{d0}—including both natives and migrants except for any refugees—in the initial year 2013. The variable of interest, m_{dt}, is defined as the share of asylum seekers without labor market access, AS_{dt} in the pre-existing local population, i.e. $m_{dt} \equiv AS_{dt}/POP_{d0}$. Because this group consists mainly of refugees that have lived in Germany for only a few months, it can be interpreted as the recent per capita inflow of asylum seekers without labor market access. By using district fixed effects, δ_d, federal state fixed effects, δ_s, a linear time trend, π_t, the interaction of district fixed effects with the linear time trend $(\delta_d \times \pi_t)$ and the interaction of state fixed effects with time fixed effects, $(\delta_s \times \delta_t)$, we control for constant and time-varying differences in the economic conditions at the aggregate level and across regions.[15] The remaining variation to identify β stems from variations in the number of asylum seekers within districts across time, disregarding district-specific time trends and state-specific shocks.

For the purpose of estimation, we take yearly differences and obtain:

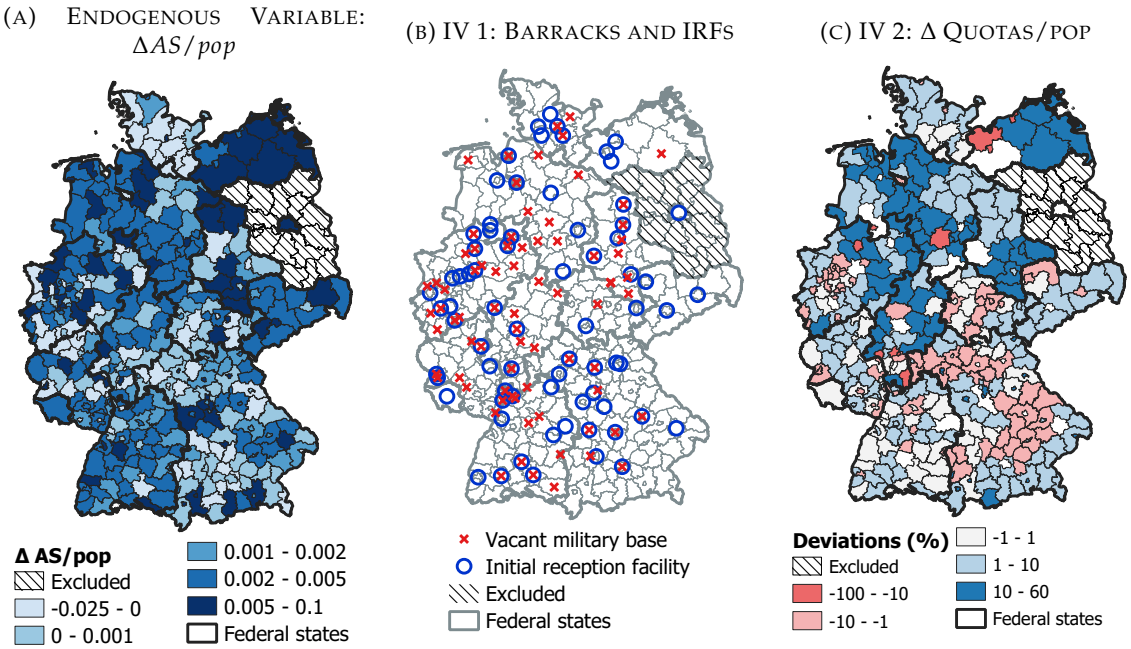
$$\Delta y_{dt} = \beta \times \Delta m_{dt} + \delta_d + (\delta_s \times \delta_t) + \varepsilon_{dt}, \tag{1.12}$$

where Δ denotes the first difference operator. Taking first differences does not change the interpretation of β. The district fixed effects δ_d result from the district-specific time trends in equation (1.11) and the coefficients for the state fixed effects control similarly for time trends at the state level. The interaction of state fixed effects with a linear time trend $(\delta_s \times \delta_t)$ controls for the time trend of shocks at the state level.

We are interested in identifying β as the effects of the (per capita) inflow of new asylum seekers on different labor market outcomes (per capita). In order for β to estimate a causal effect, the allocation of immigrants must be orthogonal to time-varying local labor market shocks around the district-specific linear trends. In Section 1.2.1 and Appendix

[15] We prefer to include these linear time trends as we find indications that asylum seekers were selected into regions not only with different labor market characteristics, but also with different labor-market trends (column 1 of Table 1.3). d, s, j and t indexes districts, federal states, sectors and time, respectively. By including federal state $\times$ time fixed effects we also control for regional differences in the implementation of asylum and integration policies that are usually defined on the state level as well as for variations in the Königstein Key (the state specific refugee quotas that are based on tax revenues and population).

FIGURE 1.2: REGIONAL VARIATION OF ENDOGENOUS VARIABLE AND INSTRUMENTS ON 31 DECEMBER 2015



Notes: The state of Brandenburg is dropped from the analyses (hatched areas). Maps 1.2a and 1.2c show numbers for 31 December 2015. Map 1.2b indicates districts that hosted an initial reception facility (as reported in the AZR) at any time between 2013h2 and 2017h2 and vacant military bases in mid-2015. Map 1.2c shows percentage deviations from a hypothetically uniform distribution by working age population in each state. In blue districts, more asylum seekers have been assigned and in red areas less asylum seekers have been assigned than in a uniform distribution.

1.A.3 we provide evidence that despite the dispersal policy this condition did not hold. This point is reiterated by panel (A) of Table 1.3, which indicates (marginally) less favorable pre-treatment unemployment trends in regions that later received more refugees. For those reasons we base our analysis on an instrumental variables approach.

1.4.2 Instrumental Variables Approach

Figure 1.2a shows the variation in our endogenous variable, i.e. the inflow of asylum seekers without labor market access per capita. It shows substantial variation within and across states in late 2015, which should have not been the case had asylum seekers been distributed proportionally to the population. Addressing this type of regional sorting by a classical shift-share IV approach is not feasible in the case of refugees because hardly any individuals from the asylum countries were living in Germany prior to the recent immigration episode.[16] This is why we rely on new instruments.

As a first instrument, we exploit the presence of large vacant military compounds that were often used as initial reception facilities and as large-scale temporary group accommodations (Figure 1.2b). Thus, this first instrument especially captures those refugees

[16] For example, Syrians were the largest group arriving in 2015—2016 (nearly 750,000 living in Germany in 2018 or nearly 0.9% of the population). However, prior to this immigration episode, only about 30,000 Syrians (0.04% of the population) lived in Germany. Source: Statistisches Bundesamt (Destatis) (2019).

who have recently arrived and therefore still live in an IRF. For the purposes of estimation, we construct a dummy variable that takes the value of 1 if in a certain district a military base was available in 2015 which was no longer in use (Barracks). We interact this variable with another dummy for the peak of refugee immigration during the second half of 2015 and the full year of 2016 (D[2015/16]):

$$\text{IV1} = \text{Barracks} \times \text{D}[2015/16]. \tag{1.13}$$

Vacant military compounds have the advantage that their location was chosen based on military and not on economic considerations. Nevertheless, the previous closure of a military base could have posed a negative demand shock that struck the regions before the refugees arrived—which is especially relevant in case a closure took place shortly before.[17] To prove whether this is a threat for the validity of our instrument we take four steps. First, we provide results based on only those military bases that have been vacant for a period of at least five years (Section 1.6.6). After this period, the potential adjustment processes as a consequence of its closure have most probably disappeared or become negligible. Second, we show that districts that had a vacant military base in 2015 do not systematically differ in their pre-treatment labor market trends from those who do not. Figure 1.A1 in the appendix illustrates that once the fixed effects from our empirical model have been accounted for, employment growth in districts with and without vacant military bases evolves flat and parallel until mid-2015, but increases as refugee immigration peaks in districts that host a vacant military compound. Third, Table 1.A5 in the appendix compares districts with and without military bases in late 2013, i.e. before the arrival of asylum seekers. It reiterates that the district that hosted a vacant military base did not differ statistically significantly from other districts in terms of various labor market characteristics and labor market trends. Finally, the insignificant pre-trends results in panel (B) of Table 1.3 suggest the same.

As a second instrument we use the hypothetical number of assigned refugees to districts based on the administrative quotas (Figure 1.2c). This second instrument is based on the allocation quotas, which apply to the allocation from IRFs to subsequent allocation and therefore captures refugees who have already left an IRF. For this purpose we multiply the number of refugees actually assigned in the "EASY" algorithm to federal states by the official within-state quotas that were effective at the time. This yields[18]

$$\frac{\text{assigned AS}_{\text{dt}}}{\text{POP}_{\text{d0}}} = \underbrace{\frac{1}{\text{POP}_{\text{d0}}}}_{Normalization} \times \underbrace{\frac{\text{assigned AS}_{\text{dt}}}{\text{assigned AS}_{\text{st}}}}_{District-quota} \times \underbrace{\text{assigned AS}_{\text{st}}}_{State-assignments}, \tag{1.14}$$

where assigned AS stands for the number of asylum seekers that are assigned by administrative dispersal mechanisms to the state level (s) and the district level (d), respectively. For the purposes of estimation, we construct this second instrument as we did with the

[17] Indeed, Moore and Spitz-Oener (2012) indeed suggest that the withdrawal of the US Army from many German bases after the fall of the Iron Curtain was a negative demand shock for local labor markets.
[18] See Appendix 1.A.2 for details.

TABLE 1.3: PRE-TRENDS

Main coefficient of interest:	Δ Employment/pop			Δ Unemployment/pop
	All	Non-tradables	Tradables	
	(1)	(2)	(3)	(4)
Panel (A): Outcome: Endogenous variable (Δ AS/POP)				
$\Delta Emp/pop$ (1-year lag)	-0.04	-0.03	0.00	0.07*
	(0.03)	(0.02)	(0.01)	(0.04)
R^2	0.31	0.31	0.31	0.31
Observations	2,639	2,639	2,639	2,639
Panel (B): Outcome: IV 1 (Barracks×D[2015/16])				
$\Delta Emp/pop$ (1-year lag)	-1.08	-1.32	0.32	3.68
	(2.47)	(1.59)	(2.19)	(4.58)
R^2	0.56	0.56	0.56	0.56
Observations	2,639	2,639	2,639	2,639
Panel (C): Outcome: IV 2 (Δ assigned AS/POP)				
$\Delta Emp/pop$ (1-year lag)	-0.01	-0.00	-0.00	0.02
	(0.01)	(0.01)	(0.01)	(0.02)
R^2	0.87	0.87	0.87	0.87
Observations	2,639	2,639	2,639	2,639
Time × state FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes

Notes: The pre-trends estimates regress the two instruments separately on the different labor market outcomes with a one-year lag. The administrative quotas and the labor market outcomes are expressed as yearly differences and normalized by population excluding refugees in the base year 2013. All estimates are weighted with the normalization variable. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

dependent variable of interest:

$$\text{IV 2} = \Delta\left(\frac{\text{assigned AS}_{dt}}{\text{POP}_{d0}}\right) = \frac{1}{\text{POP}_{d0}} \times \Delta\left(\frac{\text{assigned AS}_{dt}}{\text{assigned AS}_{st}} \times \text{assigned AS}_{st}\right), \quad (1.15)$$

i.e. where the first difference of the administratively assigned asylum seekers in a district is given by the change in the quota of the asylum seekers of the district times the change in the number of asylum seekers dispersed to the federal state by the EASY system.

The number of hypothetically assigned refugees based on the administrative quotas can be influenced neither by local authorities nor by asylum seekers themselves, which removes potential biases from regional sorting. The quotas are defined centrally in each state and are based on objective criteria—population first and foremost. In addition, the EASY-allocations were recorded automatically and are therefore less prone to potential measurement error that may afflict AZR register data. After normalizing by population and controlling for district fixed effects, we argue that the quotas are very unlikely to reflect local labor market conditions.[19] Nevertheless, the allocation criteria could in principle be correlated with our outcome variables, which we will now test empirically. Table

[19] The only exception where we doubt this assumption is the state of Brandenburg, which uses local employment shares in addition to population to calculate the distribution quotas. Therefore we have dropped Brandenburg from the analyses.

TABLE 1.4: FIRST STAGE

	(1)	(2)	(3)
D[Military Base] Δ D[time 2015h2-2016h2]	0.001***		0.001**
	(0.000)		(0.000)
Δ Quota-based assignments/pop		0.432***	0.426***
		(0.107)	(0.107)
Time × State FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Observations	2,639	2,639	2,639
Effective F-stat	5.93	14.1	10.01
Crit. value 5% bias	*37.42*	*37.42*	*8.56*
Crit. value 20% bias	*15.06*	*15.06*	*4.75*
Hansen J (overid)	0.00	0.00	0.88
P-val. Hansen J			0.35

Notes: All variables are expressed in yearly differences and normalized by population excluding refugees in the base year 2013. All regressions are weighted with the normalization variable. The coefficients shown are for asylum seekers without labor market access. The effective F-statistics are calculated based on Montiel Olea & Pflueger (2013) and their critical values are used accordingly. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

1.3, panel (C) shows the results of pre-trend regressions with the quota-based instrument as the dependent variable and lagged labor market outcomes as the explanatory variables. All coefficients are statistically insignificant, which indicates that the quotas do not correlate with previous labor market trends.[20]

In sum, the first instrument focuses on recently arrived asylum seekers (still living in IRFs) while the second one applies later in the allocation process (from IRFs to districts). Thus, they complement each other. Importantly, both do not correlate with past employment trends.

1.4.3 First Stage

Table 1.4 shows the results of the first-stage regressions of both instruments on the endogenous variable (the yearly change in asylum seekers without labor market access per population). The first two columns refer to the single instruments, while column (3) combines both. The coefficients of the two instruments remain stable in column (3), which supports our argument that they are uncorrelated and predict different types of refugee inflows.

Both instruments are positively and significantly correlated with the arrival of refugees without labor market access. We estimate effective F-statistics to test for weak identification in the case of clustered standard errors (see Montiel-Montiel Olea & Pflueger, 2013;

[20] This instrument reflects within-state quotas that allocate asylum seekers across districts for subsequent accommodation. Therefore it has no predictive power for asylum seekers that still live in reception facilities and have not yet been allocated to subsequent accommodation by the second step of the allocation procedure. For this reason, we set the instrument to zero in districts that host an IRF.

Pflueger & Wang, 2015; and Andrews, Stock & Sun, 2019).[21] If we define strong instruments to have a maximal relative bias (τ) of 5% (compared with the bias of OLS), we can reject weak instruments at a confidence level (α) of 5% only if we use both instruments jointly (because $10.012 > 8.561$). This is why we choose column (3), i.e., the combination of both instruments as our preferred specification. Figure 1.A2a illustrates the first-stage relationship in a scatter plot. As for the remaining variation, which is used in the second stage, Figure 1.A2b shows the variation between the residualized explanatory variable (i.e. after the first stage) and the outcome variable on total employment. Both plots show no outliers, or suspicious patterns.

We use a two-stage-least-squares procedure for estimation based on equation (1.12). We cluster standard errors on the level of districts and weight our estimates by the working age population in each district if not stated otherwise.

1.5 Data and Estimation

Our analysis is based on a bi-annual panel of 377 districts[22] that covers the period 2014-2017 (Appendix 1.A.5 for details). It combines novel data on asylum seekers in Germany with the allocation quotas. We further append the resulting data set with publicly available regional data from official population and employment statistics.

We retrieved a customized extract from the Central Registry of Foreigners (AZR), a database that is administered by the Federal Office for Migration and Refugees (BAMF) and used by many public authorities. In contrast to other data sets that have been used so far, this extract provides not only information on the universe of refugees by nationality and district of residence, but also on the month of arrival in Germany and the authority that is in charge of registration (e.g. an IRF or a district authority). This is crucial because it allows us to identify precisely all asylum seekers who do not have labor market access either due to having arrived recently (within the last three months) or due to living in an IRF. We use the AZR data on a half-yearly basis starting in the second half year of 2013 until the end of 2018.[23]

From the BAMF, we also obtained a data set with the exact monthly assignments of asylum seekers to federal states by the EASY system. Finally, we contacted the responsible ministries in all federal states to provide us with the quotas that they used each year to decide how many refugees the districts were to receive. For as far as we know,

[21] These effective F-statistics are not comparable between estimations with different numbers of instruments. Instead, they need to be compared with the specific critical values for the case of one or two instruments. These critical values for the maximal relative bias are shown at the bottom of Table 1.4.

[22] These correspond to NUTS 3-level ("Kreise und kreisfreie Städte'") with an average of 200,000 inhabitants.

[23] Alternative data on the recipients of asylum seeker benefits are unsuitable for this kind of analysis because asylum seekers drop out of the data as soon as they receive a positive asylum decision. For this reason, (1) benefit recipient data also includes refugees who have labor market access and are working, (2) refugees reported in the data are selected based on the duration of their application process, and (3) comparisons across time are impossible due to strongly varying durations of the asylum application processes.

neither such a detailed breakdown of the AZR, nor the regional EASY allocations nor the within-state quotas for districts have been used in the literature.[24]

Our data on military compounds stems from the Institute for Federal Real Estate ("Bundesanstalt für Immobilienaufgaben"). This agency manages the real estate owned by the Federal Republic of Germany. The administration of military bases on German territory that have been abandoned by German, American, British, French or Soviet armed forces are among the objects that fall under the agency's tasks. During the large refugee inflow, the Institute for Federal Real Estate was able to rent out large spaces to local authorities at very short notice, which were then frequently transformed into provisional housing or reception facilities. We obtained a list from the institute with all vacant army barracks (i.e. military buildings that could be used for residential purposes) that were under its administration in late 2015. It includes a brief description of the properties, the land size and the date when they were put under administration of the agency.

We obtain data on the aggregate numbers of employees in different industries[25] as well as on the number of unemployed individuals by gender, age, educational level and nationality groups from the official statistics of the Federal Employment Agency (BA). Employment and unemployment data are available on a monthly basis. For the individual wage regressions, we also rely on the SIAB register data[26], a 2% sub-sample of all German social security records that allows us to track individuals over time. Both the employment data set and the SIAB only cover employees who are dependent employees, unemployed or benefit recipients and excludes both public servants and the self-employed. Data on regional population numbers were obtained from the Federal Statistical Office.

1.6 Results

1.6.1 Main Results

This section reports the main results, i.e. the effects of the number of asylum seekers without labor market access on local employment in tradable and non-tradable sectors and on unemployment. The top panel of Table 1.5 presents results from our preferred IV specification: hosting one additional asylum seeker in a district leads to a statistically significant increase in local employment by about 0.42. Put differently, for roughly every 2.4 asylum seekers, local employment increases by one job. Simultaneously, regions with a higher inflow of asylum seekers also experience significant reductions in local unemployment with a magnitude of about 55% of the employment gains (-0.23, column 4). The employment effects are entirely driven by employment in non-tradable sectors

[24] Hennig (2019) in an unpublished manuscript employs likely the same within-state allocation quotas but uses only the differences between the quotas and the hypothetical distribution had only population been used in the quota. Hence, variation stems only from those four (out of 16) federal states that distribute based on more than population alone.

[25] The tradable sectors include agriculture and manufacturing and the non-tradable sectors subsume all other sectors (Table 1.7). In June 2014, one quarter (7.25 million employees) worked in tradable sectors and three quarters (22.69 million employees) in non-tradable sectors.

[26] This is documented in Frodermann, Schmucker, Seth & Vom Berge (2021)

(with a coefficient of about 0.53), while point estimates for tradable sectors are statistically insignificant. Together, these findings support the hypothesis from our theoretical framework that hosting refugees induces substantial labor demand effects that are heavily concentrated in non-tradable goods and services. These core results (positive and significant employment effects that stem from non-tradable services) do not depend on the selection of fixed effects (Appendix Table 1.A9)[27] and are robust to controlling for refugees *with* labor market access and other forms of immigration (Table 1.A10).

TABLE 1.5: MAIN RESULTS

Outcome	Δ Employment/pop			Δ Unemployment/pop
	All	Non-tradables	Tradables	
	(1)	(2)	(3)	(4)
		Panel (A): IV		
Δ AS /pop	0.42**	0.53***	-0.14	-0.23***
	(0.20)	(0.19)	(0.10)	(0.09)
Observations	2,639	2,639	2,639	2,639
		Panel (B): OLS		
Δ AS /pop	0.04	0.09*	-0.05	-0.04***
	(0.03)	(0.04)	(0.04)	(0.01)
Observations	2,639	2,639	2,639	2,639

Notes: All variables are expressed in yearly differences and normalized by population in working age. All regressions are weighted with the normalization variable. The coefficients are for asylum seekers without labor market access. All estimates include district fixed effects and time-state fixed effects. IV estimates include both barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

When OLS is compared with the IV results (panel B of table 1.5), the IV estimates are between 5 and 10 times larger than OLS estimates despite pointing into the same direction. We attribute this to several reasons. First, OLS estimates are most likely downward biased because asylum seekers were disproportionally assigned to regions with unfavorable labor market conditions (Section 2.1). Second, measurement error in the AZR data will lead the OLS to underestimate the true effect (attenuation bias).[28] Third, the IV estimates must be interpreted analogously to local average treatment effects (LATE).[29] This LATE is likely to be larger than an average treatment effect (ATE) because we use vacant military bases as instruments. In this case, the "compliers" consist of those districts that

[27] In contrast to employment, the effects on unemployment depend strongly on the inclusion of the state-specific time trends, which can be interpreted as stemming from refugees being overrepresented in federal states with unfavorable unemployment trends, masking the positive (i.e., decreasing) effect on unemployment. We interpret this as an argument in favor of including the full set of fixed effects in our baseline.

[28] There was heavy under-reporting in this register data, especially during the peak of the refugee immigration in late 2015. In fact, the statistical offices estimate that about one-third of those refugees that arrived in 2015 did not enter in the register until the following year, i.e. in 2016 (Statistisches Bundesamt, 2020a, p.11). Our instruments from other data sources eliminate this bias.

[29] More precisely, in the present case of a continuous endogeneous variable, the IV estimator should be interpreted as a weighted average of different effects for different subgroups (Angrist & Pischke, 2009, p. 181ff.).

hosted large number of refugees only because they had such a compound. These compounds were often used for large-scale accommodations and for initial reception facilities that provide labor-intensive services related to initial accommodation and the processing of asylum procedures. It is reasonable, therefore, that additional labor demand per refugee was particularly large in these districts and that it is mainly this effect that we capture.[30]

Importantly, our results *cannot* be extrapolated to the national level for two reasons besides the LATE interpretation of the IV estimates. First, part of the regional effects could be explained by changing commuter flows into regions with more refugees that go unconsidered at more aggregated levels.[31] Put differently, the estimated effects include mobility responses across districts, which do not translate to the aggregate (also Dustmann et al., 2017). Second, we can identify only the effects on those jobs that are created on the same local level to which refugees are assigned, and not, say, those created in the central administration.

Summing up our main results, the IV estimates show substantial increases in local employment, mainly in non-tradables, and a large reduction in local unemployment. This corroborates the predictions of our theoretical model in equation (1.8) according to which, the demand shift towards non-tradable goods in the case of an employment ban and strong wage rigidities, will increase employment and reduce unemployment.

1.6.2 Individual Wages

So far, we have discussed the effects of hosting additional refugees on employment and unemployment growth. However, from theory, we also expect that wages will tend to increase if they respond to the demand shift towards tradable goods and services. In order to test for wage effects, we shift the analysis to the individual level and analyze incumbent workers at their sector of employment in 2014, i.e. before the onset of the refugee inflow.

Specifically, we adapt equation (1.12) to read:

$$\Delta \ln w_{ifdt} = \beta \times \Delta m_{dt} + \gamma' \Delta \mathbf{x}_{ifdt} + \phi_i + \delta_d + \delta_{st} + \xi_{ifdt} \tag{1.16}$$

where w_{ifdt} is the daily wage of individual i in district d at time t and $\mathbf{x}_{ifdt}$ is a vector of time-varying characteristics at the individual and firm level (firm size, job tenure and its square, highest educational attainment and four categories for task requirements). On top of the previously used district and time$\times$state fixed effects, the vector ϕ_i controls for individual fixed effects. β is identified from wage variation within individuals over time controlling for unobserved time constant characteristics, while allowing for firm or sector switches as part of the treatment effect.

[30] Appendix Table 1.A6 shows results when using the IVs separately and supports the hypothesis that the LATE is particularly large when using the barracks instrument.

[31] We find suggestive evidence that about a quarter of the overall employment gains could be attributed to increasing commuter inflows into regions with high refugee immigration (Table 1.A7).

TABLE 1.6: INDIVIDUAL WAGE EFFECTS

	Outcome: Δ Individual wages		
	All (1)	Non-tradables (2)	Tradables (3)
Δ AS /pop	0.41	0.37	0.27
	(0.33)	(0.33)	(0.52)
Observations	2,209,975	1,488,000	721,975
District FE	×	×	×
Time × state FE	×	×	×
Individual FE	×	×	×
Firm FE	×	×	×

Notes: The estimation is based on equation (1.16). All variables are expressed in yearly differences and the refugee inflow is normalized by population size excluding asylum seekers in the base year 2013. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Column (1) of Table 1.6 presents the coefficients of interest β.[32] In the present context, an increase of about 0.005 asylum seekers without labor market access per population—corresponding to the upper quintile of refugee immigration in late 2015—would translate into wage growth of about 0.20 log points for total wages, 0.18 log points in non-tradable sectors and 0.14 log points in tradable sectors. Yet, these effects are all not statistically significant.[33] Thus, although the coefficients of the wage regressions have the expected signs, we cannot conclude that the influx of refugees has raised wages at the local level. Finding significant employment but insignificant wage effects is not surprising in the context of German labor market institutions with a high coverage of collective bargaining and widespread wage rigidities. This holds true in particular for all forms of public sector employment, including education, integration and labor market programs, but also for the construction sector and temporary agency work. Here, wages are usually fixed at the sectoral level and have small variances across firms and regions. In a nutshell, finding zero wage effects in the short run is highly plausible in the context of the German labor market institutions and wage-setting mechanisms under study here.

1.6.3 Heterogeneity by Industry Sectors

Which industry sectors generated additional employment growth as a response to local refugee hosting? Starting from the differences between employment in tradable vs. non-tradable sectors reported above, we disaggregate these further into 16 industry sectors

[32] The coefficients in the first line can be interpreted as follows. An increase in $\frac{\Delta(AS_{dt})}{pop_{d,t0}}$ of 1, i.e. an increase in the inflow of asylum seekers of the total size of the local working-age population, would increase wages of incumbent full-time workers by 41 log points (approximately percentage points). The interpretation of the individual level wage regressions differs from the previous regressions at the aggregate level, because only the latter outcomes can be normalized by population.

[33] The same holds for wage effects across a two-year or three-year window (results available upon request).

(Table 6).[34] The estimation results show that three of these sectors display statistically significant coefficients. (i) As expected, we observe significant employment growth in public administration (roughly 20% of the total effect). This is reasonable because most of the refugees that are subject to an employment ban still live in reception facilities where the asylum procedures are managed and public authorities required additional staff. Also many different kinds of service personnel such as clerks or social workers will appear in this sector if they are directly hired by public authorities. Public sector employees are often hired in temporary contracts at first, which explains the relatively high degree of short-term employment flexibility in the public sector. (ii) The largest (marginally) significant effect is for temporary agency work, which accounts for 0.0989 jobs per refugee, or more than a quarter of the total employment effect. This suggest that temporary agency work is an important channel through which local firms and authorities recruit additional staff on short notice. In particular, low-skilled jobs for security, cleaning, maintenance and catering were often filled with temporary agency workers. (iii) Finally, effects for financing, insurance and real estate are marginally significant, which might be related to the importance of the the provision of housing and real estate for the accommodation of refugees. Estimation results for all other sectors are statistically insignificant, partly because they are imprecisely estimated, partly because the effect is close to zero. Note that in large sectors like construction the effects are more difficult to identify since the impact on overall employment there is smaller relative to sectors that are smaller and more directly affected by the demand shift through the refugee influx.

1.6.4 Heterogeneity by Different Population Groups

Table 1.8 shows the effects of newly arriving asylum seekers on employment and unemployment among several different population subgroups. This is of particular relevance from a distributional and policy perspective.

Female employment benefits somewhat more from additional labor demand through asylum immigration compared with men (but the gender difference is not statistically significant). While for males, employment gains are almost fully accounted for by reductions in unemployment, this is not the case for women. It is very likely that a substantial number of women entered the workforce from inactivity.

When distinguishing by educational levels, employment gains are roughly evenly distributed across skill-groups, i.e. workers with different occupational degrees. The effect is largest for the highly skilled, which probably has to do with new jobs created in public administration, while the effects for low-skilled employees likely contain more temporary agency workers. At the same time, the reductions in local unemployment are strongest among low skilled workers (with a statistically significant coefficient of about -0.15, corresponding to about 65% of the total unemployment effect).

The largest employment effects stem from German nationals indicating that native workers benefited overall from locally arriving refugees without labor market access in

[34] We use a disaggregation of 16 one-digit sectors that is used in the employment reporting of the federal employment agency. This is based on the 2008 classification of sectors (WZ2008, "Wirtschaftsabschnitte").

TABLE 1.7: IV RESULTS BY SECTORS

Dependent Variable: Δ Employment/pop	Coefficient	(Standard error)
Tradable sectors		
Agric., Mining, Energy, Water	0.015	(0.017)
Manufacturing	-0.155	(0.101)
Non-tradable sectors		
Scientific and Technical Serv.	0.137	(0.086)
Temporary Agency Work	0.099*	(0.056)
Education	0.086	(0.071)
Public Administration	0.083**	(0.036)
Information and Communication	0.075	(0.046)
Social Sector	0.044	(0.045)
Finance, Insurance, Real Estate	0.044*	(0.025)
Wholesale/Retail Trade	0.038	(0.061)
Other Personal Services	0.022	(0.027)
Construction	0.008	(0.021)
Human Health	-0.000	(0.027)
Accommodation and Food Services	-0.001	(0.018)
Other Commercial Services	-0.031	(0.043)
Transportation and Storage	-0.055	(0.047)

Notes: All variables are expressed in yearly differences and normalized by population in working age. All regressions are weighted with the normalization variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

the short run. This result also stresses that the employment effects are by no means driven by refugees themselves taking up employment. Generally, foreigners who arrived at an earlier point of time are at particular risk of being negatively affected by newly incoming foreigners (D'Amuri et al., 2010; Brücker et al., 2014). Yet, the results suggest that at least in the short run, immigrants from other countries than refugee-sending countries also benefit from additional employment growth and from large reductions in local unemployment. The strong reductions in local unemployment for low-skilled employees and for former non-refugee migrants are of great policy relevance, especially because these groups are particularly at risk when refugees enter the labor market themselves.[35]

Finally, additional employment growth is disproportionally high among workers younger than the age of 25, a population group that contains many new labor market entrants and students that work part-time during their studies. This group is particularly mobile and flexible. Large employment effects in combination with only small reductions in unemployment among young people suggests that the arrival of asylum seekers accelerated labor market entry among groups that are not (yet) strongly attached to the labor market. By contrast, the clearest effects on unemployment stem from persons in the main working age (25—55).

[35] A likely explanation for the unemployment effects being larger than the ones on employment for this group is that the data used records only employment subject to social security contributions (SSC), and thus does not consider marginal employment. it is likely that many foreigners took on marginal employment, i.e. so-called minijobs, which shows up empirically in decreasing unemployment but not in increasing SSC employment.

TABLE 1.8: IV RESULTS BY POPULATION SUBGROUPS

	(1) Δ Employment/pop		(2) Δ Unemployment/pop	
	Coefficient	(Standard error)	Coefficent	(Standard error)
		Total population		
Total employment	0.42**	(0.20)	-0.23***	(0.09)
		By gender		
Males	0.19	(0.12)	-0.14**	(0.05)
Females	0.23**	(0.09)	-0.09**	(0.04)
		By education		
No degree	0.12**	(0.05)	-0.15**	(0.07)
Vocational degree	0.13	(0.10)	-0.03	(0.04)
Academic degree	0.17**	(0.08)	-0.04***	(0.01)
		By nationality		
Germans	0.36**	(0.16)	-0.12**	(0.05)
Foreigners	0.06	(0.06)	-0.11**	(0.04)
Asylum countries	0.00	(0.01)		
		By age groups		
Age 15-25	0.11***	(0.04)	-0.03	(0.02)
Age 25-55	0.25*	(0.15)	-0.16**	(0.06)
Age 55-65	0.06*	(0.04)	-0.03	(0.02)

Notes: All variables are expressed in yearly differences and normalized by population excluding asylum seekers in the base year 2013. All regressions are weighted with the normalizing variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

1.6.5 Persistence of Effects

So far, the analysis has focused on the contemporaneous effect during the same year in which asylum seekers arrive. We now turn to testing whether the effects persist in the medium term.

As pointed out in the theoretical framework in Section 1.3, we expect the strong and positive demand effects that we find during this initial period will be mitigated over time for three reasons. First, after asylum applications have been decided and refugees leave IRFs and other collective housing, they receive more cash instead of in-kind benefits and demand fewer locally produced non-tradable services, reducing the impact on local labor demand. Second, refugees will start working themselves, slowly phasing in a labor supply effect that increases over time. That has two implications: on the one hand, they tend to increase labor supply gradually and thus increasingly compete with the pre-existing labor force; on the other, the household income of the refugee population tends to increase with employment, which, in turn, reduces the demand effect. Third, the capital stock tends to adjust to demand and labor supply changes, which neutralizes the potential labor-market effects from the refugee influx. Next, therefore, we investigate the effects of newly arrived asylum seekers over longer periods.

For that purpose, we prolong the time horizon of the outcome variables so that they are measured as differences over two- or three-year windows, instead of one-year differences. Specifically, in the baseline estimates, the outcome was measured as $\Delta L_{d,t} = L_{d,t} - L_{d,t-1}$ (one-year window), which we now change to $\Delta L_{d,t} = L_{d,t+1} - L_{d,t-1}$ (two-year window) or $\Delta L_{d,t} = L_{d,t+2} - L_{d,t-1}$ (three-year window), respectively. This means that only the left-hand-side variable in equation (1.12) is modified, while the right-hand side and the first stage remain unchanged. Importantly, these estimates cannot be interpreted any more as pure demand effects, because asylum seekers gain labor market access and slowly start taking up employment.

TABLE 1.9: EFFECTS OVER LONGER TIME SPANS

Outcome	Δ Employment/pop			Δ Unemployment/pop
	All	Non-tradables	Tradables	
	(1)	(2)	(3)	(4)
Panel (A): 1-year window (baseline)				
Δ AS /pop	0.42**	0.53***	-0.14	-0.23***
	(0.20)	(0.19)	(0.10)	(0.09)
Observations	2,639	2,639	2,639	2,639
Panel (B): 2-year window				
Δ AS /pop	0.32*	0.41**	-0.12	-0.10
	(0.19)	(0.20)	(0.12)	(0.08)
Observations	2,639	2,639	2,639	2,639
Panel (C): 3-year window				
Δ AS /pop	0.15	0.02	-0.09	-0.10
	(0.18)	(0.28)	(0.20)	(0.08)
Observations	2,639	2,639	2,639	2,639

Notes: The estimation is based on equation (1.12): All variables are normalized by population size excluding asylum seekers in base year 2013. All regressions are weighted with population excluding asylum seekers. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

The key result is that over the medium run, the employment effects of hosting refugees remain positive, but fade out and become insignificant over the three-year window (Table 1.9). The effects on unemployment dilute even faster. An explanation for this finding is provided by considering population subgroups (Appendix Table 1.A8). New jobs for low-skilled workers are particularly short lived, and these are most likely to be filled by the unemployed. Only high skilled employment gains are persistent, which might be because the kind of services that asylum seekers require change over time. While in the very short run, emergency accommodation was the priority, over time, integration services that require skilled instructors like language training and integration courses become more important.

1.6.6 Robustness of Different Specifications

In this section we test the results for robustness to different specifications.

The results could be sensitive to the specification of the estimation equation with regard to different sets of fixed effects (Appendix Table 1.A9). The employment effects remain of the same magnitude but are slightly smaller (and not larger as one might expect). The effects on unemployment are substantially smaller than in our preferred specification and not statistically significant any more when leaving out state-specific time trends. The fact that unemployment effects depend strongly on the inclusion of the state-specific time trends can be interpreted as stemming from refugees being overrepresented in federal states with unfavorable unemployment trends, thus masking the positive (i.e., decreasing) effect on unemployment. We interpret these results as underlining the importance of including the full set of fixed effects.

The estimates could be confounded if the arrival of asylum seekers subject to an employment ban was correlated with a simultaneous increase of other immigrant groups, e.g. of asylum seekers allowed to work or of other foreigners. The results in Table 1.A10 suggest that this was not the case since the IV estimates remain almost unchanged when we include additional immigrant groups as control variables. This supports the view that the (contemporaneous) results are indeed driven by those asylum seekers who are banned from working.

We estimate the model only for the period of the major refugee influx insofar as we study only the years 2015 and 2016. The effects that are displayed in column (2) of Table 1.A11 are of similar magnitude to those in the baseline specification. We interpret this as an indication that our results stem from the period around the peak of the refugee inflow. This not only confirms our expectations concerning the timing of the effects; it also supports our argument that we have measured short-run effects from the recent immigration shock and that longer-run adjustments to previous migration exposure are unlikely to bias our estimates.

Robustness checks for a few further variations are displayed in Table 1.A11. First, we check whether the effects are driven by a relatively small group of districts that host an IRF. Column (3) indicates that when dropping those districts with IRFs from the regressions, the instruments get weaker and the estimates lose their statistical significance, but remain large. We interpret this to indicate that reception facilities are an important source of variation but not the only driver of the results. Second, we have experimented with including and excluding more and fewer Federal States in the estimations. In column (4) we include Brandenburg, which is not part of the baseline study because it allocates refugees based on regional employment shares, which could violate the exclusion restriction. Column (5) excludes not only Brandenburg, but also Hesse, which uses foreigner shares in its distribution quotas. In both cases, the results change only marginally, supporting the robustness of the results.

Finally, we show that the results remain robust if we restrict the barracks instrument to those military bases that have been abandoned and put under the administration of the Federal Institute for Real Estate prior to 2010 (column 6). If any labor market adjustments

to the withdrawal of troops have occurred in these districts, they are very likely to be concluded by the arrival of the asylum seekers in 2015. Again, the results remain very close to the baseline results and as such very robust.

1.7 Conclusions

This paper analyzes how the demand induced by immigration affects employment and wages on local labor markets. The large and unexpected inflow of refugees to Germany constitutes a natural experiment providing a unique opportunity for studying the demand effect. It does so for three reasons. First, asylum seekers were banned from working in the initial phase after arrival, which allows us to analyze the demand effects in isolation from labor supply effects. Second, refugees consume at near subsistence level and receive largely in-kind social benefits. The high share of necessities in private consumption (such as housing) together with the high expenditures of publicly provided services (such as administration, education, integration programs and security) involve a demand shift towards labor-intensive non-tradable sectors. Third, the administrative dispersal of refugees together with a binding residence requirement allows the identification of a causal effect. Empirical identification is not straightforward as some endogeneous regional sorting remains due to a combination of overburdened authorities, the attrition of refugees, systematic measurement error and political lobbying. We solve this issue by exploiting exogenous variation that stems from the availability of vacant military bases and administrative allocation quotas. Both instruments are uncorrelated with labor market outcome variables as demonstrated by analyzing the trends prior to the refugee immigration surge. Form this, we argue that our identification strategy delivers causal estimates.

The theoretical framework predicts that the shift in the consumption structure and corresponding changes of goods and factor prizes will induce growing relative wages or employment since non-tradable sectors are intensive in domestic labor. These theoretical expectations are corroborated by our empirical findings. The empirical results show that the employment effects of the refugee influx in the initial phase after arrival, i.e. in the phase when the employment ban is effective, are substantial: a one percentage point increase in the local population through the immigration of asylum-seekers increases the employment rate by 0.42 percentage points in the short-run. Put differently, for every 2.4 asylum seekers hosted, one job is created in the respective district. Employment gains are fully driven by non-tradable sectors, especially in public administration and in temporary agency work, while the tradable sectors are unaffected. At the same time, unemployment is reduced substantially, making up about 55% of employment gains. The coefficients for individual wages have the expected positive signs but statistically are no different from zero. Finding labor demand effects from immigration on employment and unemployment rather than on wages is well in line with German labor market institutions which are characterized by high levels of collective bargaining coverage and wage rigidities. Our findings also demonstrate that the initial employment gains tend to get

diluted in the medium term, i.e. two or three years after the refugee inflow, and most coefficients no longer appear statistically significant. This is also in line with our expectations from theory, since the rising labor supply of the refugee population, the adjustment of capital stocks and the mitigation of demand-shift effects by rising income levels should neutralize positive demand effects in the medium term or longer.

The results presented here advance our understanding of how immigration affects host-country labor markets in three ways. First, we isolate a pure labor demand effect of immigration on the resident population, which is about half the size of the pure supply effects from immigration that have been found by Dustmann et al. (2017). We therefore argue that potential labor-demand effects need to be considered when studying the effect of immigration on labor markets. Otherwise, researchers might miss important mechanisms and potentially overrate resulting (negative) labor-market effects. Thus, this paper contributes to explaining why many studies find that migration has little to no effect on wages and employment.

Second, our theoretical framework illustrates the underlying mechanism according to which non-homothetic demand functions translate immigration into a demand shift towards non-tradables. The theoretical framework and empirical analysis indicate that the relative importance of such demand effects is particularly large (1) if short-run effects are studied and potential other adjustments to the labor market shock have not yet taken place, (2) if immigrants differ from natives in terms of their income and, hence, their consumption structure, and (3) if immigrants do not (immediately) take up employment after arrival. The latter scenario is highly relevant beyond refugee migration, such as when thinking about migration for family reunification or educational purposes. Condition (2) is expected to hold in a variety of migration settings because in many contexts the average household income, especially of recent arrivals, is well below that of the native population average. Hence, we argue that demand effects are relevant for many immigration settings.

Third, we contribute to the discussion about the local costs and benefits of hosting refugees. Our study emphasizes that during the first one to two years after arrival, the positive effects of hosting asylum seekers on local labor demand are substantial and can outweigh labor supply effects. Policy makers should take particular note that employment gains were strongest among women, many of whom newly entered the labor force. Low-skilled individuals and foreigners benefited strongly from short-run decreases in unemployment. These two groups in particular are usually at highest risk from competition by new immigrants. However, these effects fade out after about two years.

Finally, we claim that the novel empirical identification approach provided in this paper is of particular relevance. Future research could build on this approach to study a wide range of labor market outcomes, integration dimensions, fiscal effects, etc. which are important to understand due to the historical size of the inflow of asylum seekers. Last but not least, the consumption patterns of immigrants in general and of refugees in particular are not yet well documented and understood, but they may have long-lasting effects on host economies.

1.M Appendix: The Model

1.M.1 Demand

The indirect utility function in equation (1) of the main text belongs to the family of PIGL-preferences, for which the indirect utility function can be written in its most general form as

$$V(P,e) = \left[\frac{e}{b(P)}\right]^{v} \left[\frac{a(P)}{b(P)}\right]^{v},$$

where e is expenditure, P a vector of prices, $a(P)$ and $b(P)$ linear homogenous functions of the price vector, and $v > 0$ a parameter (Muellbauer, 1976). The specific form we apply in equation (1) of the main text has been proposed by Boppart (2014). This indirect utility function has only a closed form representation in the limiting case that $\epsilon = \gamma$. In this case the indirect utility function simplifies to $V(\cdot) = \ln \frac{e_h}{p_T} - \left(\frac{p_N}{p_T}\right)^{\gamma} + \frac{\beta}{\gamma}$ and we can write the direct utility function as

$$U^h(X_N, X_T) = \frac{1}{\epsilon} X_T^{\epsilon} \frac{\left(\frac{X_N}{\beta}\right)^{\frac{\epsilon}{1-\epsilon}} - \beta}{\left[\left(\frac{X_N}{\beta}\right)^{\frac{1}{1-\epsilon}} - X_N\right]^{\epsilon}} - \frac{1-\beta}{\epsilon},$$

which is *inter alia* used by Egger & Habermeyer (2022) and others. In our further analysis, however, we employ the more general form of the indirect utility function in equation (1) of the main text. This indirect utility function is only valid if and only if $e_h^{\epsilon} \geq \frac{1-\epsilon}{1-\gamma} \beta p_N^{\gamma} p_T^{\epsilon-\gamma}$ (Boppart, 2014), which we assume to hold.

We can derive the expenditure function e_h of household h by rewriting the indirect utility function ($V^h \equiv V(X_N, X_T, e_h)$) in equation (1.1) of the main text to

$$e(p_N, p_T, V^h) = \left[\epsilon \left[V^h + \frac{\beta}{\gamma}\left(\frac{p_N}{p_T}\right)^{\gamma} + \frac{1}{\epsilon} - \frac{\beta}{\gamma}\right]\right]^{\frac{1}{\epsilon}} p_T. \tag{1.M.1}$$

Differentiating the expenditure function with respect to prices delivers the Marshallian demand functions

$$X_N^h = \beta \left(\frac{e_h}{p_T}\right)^{1-\epsilon} \left(\frac{p_T}{p_N}\right)^{1-\gamma}, \quad X_T^h = \left(\frac{e_h}{p_T}\right)^{1-\epsilon} \left[\left(\frac{e^h}{p_T}\right)^{\epsilon} - \beta \left(\frac{p_T}{p_N}\right)^{1-\gamma}\right]. \tag{1.M.2}$$

The Allen-Uzawa formula for the elasticity of substitution is given by $\sigma_D^h = \frac{\partial^2 e^h}{\partial p_T \partial p_N} \frac{e^h}{\partial e^h/\partial p_N \partial e^h/\partial p_T}$, where $\frac{\partial e_h}{\partial p_N}$ and $\frac{\partial e_h}{\partial p_T}$ are given by 1.M.2 and

$$\frac{\partial^2 e^h}{\partial p_T \partial p_N} = \beta p_N^{-(1-\gamma)} p_T^{-\gamma} \left(\frac{e^h}{p_T}\right)^{1-2\epsilon} \left[\beta(1-\epsilon)\left(\frac{p_N}{p_T}\right)^{\gamma} - (1-\gamma)\left(\frac{e^h}{p_T}\right)^{\epsilon}\right].$$

Substituting these expressions into the Allen-Uzawa formula yields

$$\sigma_D^h = 1 - \gamma - (\gamma - \epsilon)\frac{\beta\left(\frac{p_N}{p_T}\right)^{\gamma}}{\left(\frac{e_h}{p_T}\right)^{\epsilon} - \beta\left(\frac{p_N}{p_T}\right)^{\gamma}}, \tag{1.M.3}$$

which is smaller than one if $\gamma > 0$ and declines if household income increases provided that $\gamma \geq \epsilon$.

The expenditure shares of the households can be written as

$$s_N^h = \beta\left(\frac{p_T}{e_h}\right)^{\epsilon}\left(\frac{p_N}{p_T}\right)^{\gamma}, \quad s_T^h = 1 - \beta\left(\frac{p_T}{e_h}\right)^{\epsilon}\left(\frac{p_N}{p_T}\right)^{\gamma}. \tag{1.M.4}$$

Thus, $\frac{\partial s_N}{\partial e_h} \leq 0$ and $\frac{\partial s_T}{\partial e_h} \geq 0$, i.e. the expenditure share of non-tradables tends to fall with increasing household income, i.e. the Engel-curves are non-linear.

Aggregating the expenditure shares delivers

$$s_N = \beta\left(\frac{E}{p_T H}\right)^{-\epsilon}\left(\frac{p_N}{p_T}\right)^{\gamma}\psi, \quad s_T = 1 - \beta\left(\frac{E}{p_T H}\right)^{-\epsilon}\left(\frac{p_N}{p_T}\right)^{\gamma}\psi, \tag{1.M.5}$$

where the aggregate consumption expenditures are defined as $E \equiv \int_0^H e_h dh$. Furthermore, the scale-invariant inverse inequality index ψ is defined as $\psi \equiv \int_0^H \left[\frac{e_h H}{E}\right]^{1-\epsilon} dh = \int_0^H \left[\frac{e_h}{\bar{e}}\right]^{1-\epsilon} dh$, where $\bar{e} \equiv E/H$ captures average household income. The inequality index ψ is defined over the interval [0 1] and declines if the inequality of income tends to increase when demand is non-homothetic, i.e. if $\epsilon > 0$.

This also determines the aggregate Marshallian demand functions, i.e.

$$X_N = \beta p_N^{-(1-\gamma)} p_T^{\epsilon-\gamma} E^{1-\epsilon} H^{\epsilon}\psi, \quad X_T = \frac{E}{p_T} - \beta p_N^{\gamma} p_T^{-(1-\epsilon+\gamma)} E^{1-\epsilon} H^{\epsilon}\psi. \tag{1.M.6}$$

From equations (1.M.4) and (1.M.5) we can derive the income level where the expenditure share of the individual household is equal to the aggregate expenditure share in the economy:

$$e_h = e^{RA} = \psi^{-\frac{1}{\epsilon}}.$$

This expenditure share is equal to the expenditure share of the representative agent in Muellbauer's sense. Using the income level of the representative agent we can derive the price elasticity of consumers as

$$\sigma_D = 1 - \gamma - (\gamma - \epsilon)\frac{\beta\left(\frac{p_N}{p_T}\right)^{\gamma}}{\left(\frac{\bar{e}\psi^{-1/\epsilon}}{p_T}\right)^{\epsilon} - \beta\left(\frac{p_N}{p_T}\right)^{\gamma}}. \tag{1.M.7}$$

The income elasticities of demand are given by

$$\frac{\partial x_N}{\partial \bar{e}}\frac{\bar{e}}{x_N} = 1 - \epsilon, \quad \frac{\partial x_T}{\partial \bar{e}}\frac{\bar{e}}{x_T} = 1 + \epsilon\,\frac{p_N\,x_N}{p_T\,x_T}, \tag{1.M.8}$$

where we have written the average consumption per household as $x_N \equiv X_N/H$ and $x_T \equiv X_T/H$.

The elasticities of the average consumption of non-tradables and tradables with respect to income dispersion are

$$\frac{\partial x_N}{\partial \psi}\frac{\psi}{x_N} = 1, \quad \frac{\partial x_T}{\partial \psi}\frac{\psi}{x_N} = -\frac{p_N\, x_N}{p_T\, x_T}. \tag{1.M.9}$$

The price elasticity of consumer demand in equation (1.M.7), the income elasticities of mean consumption per household in equation (1.M.8) and the elasticities with respect to income dispersion in equation (1.M.9) deliver the aggregate demand system in equation (1.2) of the main text.

1.M.2 Production

The production side of the economy is modeled in a standard framework with two goods; tradables and non-tradables; two sectors and two factors of production, labor and capital. Production technologies are characterized by constant returns to scale, and competition on goods and factor markets is perfect. This framework is rather standard in the literature and has been outlined *inter alia* by Rivera-Batiz (1982, 1983) and others. It builds on a general equilibrium framework originally developed by Jones (1965). We thus limit the presentation on the main assumptions and results here.

The state of technologies in our $2 \times 2 \times 2$ economy is characterized by the matrix of input coefficients

$$A = \begin{pmatrix} a_{LN} & a_{LT} \\ a_{KN} & a_{KT} \end{pmatrix}, \tag{1.M.10}$$

where the coefficients a_{ij} represent the amount of input i ($i = \tilde{L}, K$) used in the production of output j ($j = N, T$). We assume that $a_{LN} > a_{LT}$ and that $a_{KN} < a_{KT}$, i.e. that the non-tradable sector is labor-intensive, and rule out factor intensity reversal. Note that labor is always measured in efficiency units.

Given the assumptions on production technologies we can write the matrix of factor input shares for our $2 \times 2 \times 2$ economy as

$$\lambda = \begin{pmatrix} \lambda_{LN} & \lambda_{LT} \\ \lambda_{KN} & \lambda_{KT} \end{pmatrix}, \tag{1.M.11}$$

where λ_{ij} is defined as the share of the factor input i in sector j in the total factor input i, e.g. $\lambda_{LN} = a_{LN}\frac{X_N}{\tilde{L}} = \frac{\tilde{L}_N}{\tilde{L}}$. The determinant of this matrix is given by

$$|\lambda| = \lambda_{LN} - \lambda_{KN},$$

which is positive due to the assumption that the non-tradable sector is labor intensive.[36]

[36] Note that $\lambda_{LN} + \lambda_{LT}$ and $\lambda_{KN} + \lambda_{KT}$ add up to unity, such that $|\lambda| = \lambda_{LN} - \lambda_{KN}$.

Analogously, we can write the matrix of factor income shares as

$$\theta = \begin{pmatrix} \theta_{LN} & \theta_{KN} \\ \theta_{LT} & \theta_{KT} \end{pmatrix}, \tag{1.M.12}$$

where θ_{ij} is defined as the income share of factor i in the value product of sector j, e.g. $\theta_{LN} = a_{LN}\frac{w}{p_N} = \frac{w\tilde{L}_N}{p_N X_N}$. The determinant from the matrix is given by

$$|\theta| = \theta_{LN} - \theta_{LT},$$

which is again positive since the non-tradable sector is labor intensive.

We start with the assumption that factor inputs in the economy equal total factor supplies. This assumption will be relaxed below in a setting with imperfect labor markets. This delivers for the factor inputs in each sector

$$a_{LN}X_N + a_{LT}X_T = \tilde{L}, \quad a_{KN}X_N + a_{KT}X_T = K. \tag{1.M.13}$$

Furthermore, the condition that unit costs equal factor prices under perfect competition implies that

$$a_{LN}w + a_{KN}r = p_N, \quad a_{LT}w + a_{KT}r = p_T. \tag{1.M.14}$$

Based on this notation outlined in equation (1.M.10) - (1.M.12) and the equilibrium conditions in equations (1.M.13) and (1.M.14) we can write the system in log changes as

$$\lambda_{LN}\, d\ln X_N + \lambda_{LT}\, d\ln X_T = d\ln \tilde{L} - (\lambda_{LN}\, d\ln a_{LN} + \lambda_{LT}\, d\ln a_{LT}), \tag{1.M.15.1}$$

$$\lambda_{KN}\, d\ln X_N + \lambda_{KT}\, d\ln X_T = d\ln K - (\lambda_{KN}\, d\ln a_{KN} + \lambda_{KT}\, d\ln a_{KT}), \tag{1.M.15.2}$$

$$\theta_{LN}\, d\ln w + \theta_{KN}\, d\ln r = d\ln p_N - (\theta_{LN}\, d\ln a_{LN} + \theta_{KN}\, d\ln a_{KN}), \tag{1.M.15.3}$$

$$\theta_{LT}\, d\ln w + \theta_{KT}\, d\ln r = d\ln p_T - (\theta_{LT} d\ln a_{LT} + \theta_{KT}\, d\ln a_{KT}), \tag{1.M.15.4}$$

(Jones 1965).

Using the zero-profit condition and dividing by prices we get

$$\theta_{LN}\, d\ln a_{LN} + \theta_{KN}\, d\ln a_{KN} = 0, \tag{1.M.16}$$

and

$$\theta_{LT}\, d\ln a_{LT} + \theta_{KT}\, d\ln a_{KT} = 0. \tag{1.M.17}$$

The response of the factor intensity in each industry to a change in factor endowments depends on the elasticity of substitution in each industry. This allows to write the ratio of changes in the factor intensity to the ratio of changes in factor prices in the non-tradable and tradable sector in terms of the elasticities

$$\sigma_N = \frac{d\ln a_{KN}}{d\ln a_{\tilde{L}N}} \frac{d\ln w}{d\ln r}, \tag{1.M.18}$$

and

$$\sigma_T = \frac{d \ln a_{KT}}{d \ln a_{\tilde{L}T}} \frac{d \ln w}{d \ln r}. \tag{1.M.19}$$

The last four equations can be used to solve for the changes of the factor intensities in each sector by substituting in pairs, which delivers

$$d \ln a_{Lj} = -\sigma_j \theta_{Kj} \left(d \ln w - d \ln r \right), \tag{1.M.20}$$

$$d \ln a_{Kj} = \sigma_j \theta_{\tilde{L}j} \left(d \ln w - d \ln r \right). \tag{1.M.21}$$

Substituting these expressions delivers for the system of log changes in equations (1.M.15.1) to (1.M.15.4)

$$\lambda_{LN} \, d \ln X_N + \lambda_{LT} \, d \ln X_T = d \ln \tilde{L} - \varepsilon_L \left(d \ln w - d \ln r \right), \tag{1.M.22.1}$$

$$\lambda_{KN} \, d \ln X_N + \lambda_{KT} \, d \ln X_T = d \ln K - \varepsilon_K \left(d \ln w - d \ln r \right), \tag{1.M.22.2}$$

$$\theta_{LN} \, d \ln w + \theta_{KN} \, d \ln r = d \ln p_N, \tag{1.M.22.3}$$

$$\theta_{LT} \, d \ln w + \theta_{KT} \, d \ln r = d \ln p_T, \tag{1.M.22.4}$$

where ε_L and ε_K are the elasticities of substitution weighted by the factor input and factor income shares, i.e.

$$\varepsilon_L = \sigma_N \lambda_{LN} \theta_{KN} + \sigma_T \lambda_{LT} \theta_{KT}$$

and

$$\varepsilon_K = \sigma_N \lambda_{KN} \theta_{LN} + \sigma_T \lambda_{KT} \theta_{LT}.$$

By subtracting equation (1.M.22.2) from (1.M.22.1) and noting that the determinant $|\lambda| = \lambda_{LN} - \lambda_{KN}$ and that $\lambda_{LT} = 1 - \lambda_{LN}$ and $\lambda_{KT} = 1 - \lambda_{KN}$ if factor markets clear, we receive for the supply function of the economy in log changes

$$d \ln \left(\frac{X_N}{X_T} \right) = \frac{1}{|\lambda|} d \ln \left(\frac{\tilde{L}}{K} \right) + \frac{\varepsilon_L - \varepsilon_K}{|\lambda|} d \ln \left(\frac{w}{r} \right). \tag{1.M.23}$$

Analogously, we can subtract equation (1.M.22.4) from (1.M.22.3) to obtain the relationship between factor prices and goods prices as

$$d \ln \left(\frac{w}{r} \right) = \frac{1}{|\theta|} d \ln \left(\frac{p_N}{p_T} \right), \tag{1.M.24}$$

where we have used the fact that $|\theta| = \theta_{LN} - \theta_{LT}$ and that $\theta_{KN} = 1 - \theta_{LN}$ and $\theta_{KT} = 1 - \theta_{LT}$ if profits are zero.

We can use this and rewrite the supply function in terms of relative prices on goods markets as

$$d \ln \left(\frac{X_N}{X_T} \right) = \frac{1}{|\lambda|} d \ln \left(\frac{\tilde{L}}{K} \right) + \sigma_S d \ln \left(\frac{p_N}{p_T} \right), \tag{1.M.25}$$

where the elasticity of substitution on the supply side is defined as $\sigma_S \equiv \frac{1}{|\lambda||\theta|} (\varepsilon_{\tilde{L}} + \varepsilon_K)$.

Finally, the overall equilibrium of the economy is determined by the mutual interaction of demand and supply on clearing goods markets. Thus, equating (1.M.25) with equation (2) of the main text delivers for relative prices of goods

$$d\ln\left(\frac{p_N}{p_T}\right) = -\frac{1}{|\lambda|(\sigma_S+\sigma_D)}d\ln\left(\frac{\tilde{L}}{K}\right) - \frac{\epsilon}{\theta_T(\sigma_S+\sigma_D)}d\ln\bar{e} + \frac{1}{\theta_T(\sigma_S+\sigma_D)}d\ln\psi. \tag{1.M.26}$$

Using the relationship between relative factor prices and relative goods prices from equation (1.M.24) and noting that the log change of the wage rate is given by $d\ln w = \frac{\theta_{KT}}{|\theta|}d\ln\frac{p_N}{p_T}$ we arrive at the wage equation (1.4) in the main text from these equilibrium conditions in goods and factor markets.

1.M.3 Decomposition of the Wage Equation

The change of the labor-to-capital ratio in efficiency units can be written as

$$d\ln(\tilde{L}/K) = d\ln\tilde{\alpha} + d\ln(L/K). \tag{1.M.27}$$

Mean income is a function of the capital-labor-ratio, $k \equiv K/\tilde{L}$, and mean labor productivity, $\tilde{\alpha}$. We can therefore write mean income as

$$\bar{e} = \frac{w\tilde{L}+rK}{H} = \tilde{\alpha}\frac{L}{H}\left(w+rk\right).$$

Differentiating this totally and dividing by average income delivers

$$\begin{aligned} d\ln\bar{e} &= d\ln\tilde{\alpha} + d\ln L/H + \left[\theta_{\tilde{L}T}\frac{d\ln w}{d\ln k} + \theta_{KT}\left(1+\frac{d\ln r}{d\ln k}\right)\right]d\ln k \\ &= (1-\theta_{KT})d\ln\tilde{\alpha} - \theta_{KT}d\ln L/K + d\ln L/H, \end{aligned} \tag{1.M.28}$$

where we have used the fact that $d\ln r = -\frac{\theta_{\tilde{L}T}}{\theta_{KT}}d\ln w$. Thus, migration can affect average income via changes of (i) the average productivity of the labor force, (ii) the labor-capital-ratio and (iii) the labor force participation rate of the population.

The decomposition of the inverse inequality index is more complex, since it depends on assumptions about the distribution of the capital stock and transfers. We simplify the analysis here by assuming that the capital stock and, hence, capital income, is a fixed proportion of all types of income. This relationship would emerge if the saving rate is a constant fraction of income, which is of course an arbitrary assumption though it simplifies matters here. Thus, the capital stock owned by household h is given by

$$K_h = \kappa\, w\, \tilde{L}_h,$$

where κ is a constant factor related to labor earnings. The total capital stock in the economy is thus given by $K = \kappa\, w\, \tilde{\alpha}\, L$.

The inverse inequality index is affected by non-employment and transfers. We assume here that the non-employed receive benefits which are a fraction of average income,

i.e. $b \times \tilde{\alpha}(w + rk)$, and that the transfers to the non-employed are funded by a uniform tax rate τ on all sorts of income. This delivers for the tax rate

$$\tau = \frac{(1 - L/H)b}{L/H + (1 - L/H)b}, \quad 1 - \tau = \frac{L/H}{L/H + (1 - L/H)b}.$$

The inverse inequality index can be written in case of non-employment and transfers

$$\psi = \int_0^1 \left(\frac{e_h}{\bar{e}}\right)^{1-\epsilon} dh = \frac{1}{[L/H + (1 - L/H)b]^{1-\epsilon}} \left[\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}\right], \tag{1.M.29}$$

where $\psi_\alpha = \int_{\underline{\alpha}}^{\bar{\alpha}} \left(\frac{\alpha}{\tilde{\alpha}}\right)^{1-\epsilon} d\alpha$ denotes the dispersion of labor productivity.

Differentiating this and assuming that the tax-transfer rate is constant delivers for the log change of the inverse inequality index

$$\begin{aligned} d\ln\psi = {} & \frac{L}{H} \frac{\psi_\alpha b - b^{1-\epsilon} + \epsilon(1-b)\left[\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}\right]}{\left[\frac{L}{H} + \left(1 - \frac{L}{H}\right) b\right]\left[\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}\right]} d\ln\left(\frac{L}{H}\right) \\ & + \frac{L}{H} \frac{\psi_\alpha}{\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}} d\ln\psi_\alpha. \end{aligned} \tag{1.M.30}$$

Note that the sign of the derivative with respect to the employment rate is ambiguous, since non-employment does not necessarily increase inequality. On the one hand, it increases inequality since the average income of the non-employed is below that of the employed. On the other hand, non-employment reduces it, since the dispersion of income among the non-employed who all receive the same benefits is zero. By contrast, the inverse inequality index of labor productivity unambiguously increases the inverse earnings inequality index.

Substituting the expressions from equations (1.M.27), (1.M.28) and (1.M.30) into equation (1.4) delivers, after some rearranging for the wage equation,

$$\begin{aligned} \frac{d\ln w}{d\ln M} = {} & -\frac{1}{\sigma}\left[1 - \epsilon\frac{|\lambda|}{\theta_T}\theta_{KT}\right] \frac{d\ln L/K}{d\ln M} - \frac{1}{\sigma}\left[1 + \epsilon\frac{|\lambda|}{\theta_T}(1 - \theta_{KT)}\right] \frac{d\ln\tilde{\alpha}}{d\ln L}\frac{d\ln L}{d\ln M} \\ & - \frac{1}{\sigma}\left[\frac{|\lambda|}{\theta_T}(\epsilon - \omega)\right] \frac{d\ln L/H}{d\ln M} + \frac{1}{\sigma}\frac{|\lambda|}{\theta_T}\frac{L}{H}\frac{\psi_\alpha}{\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}} \frac{d\ln\psi_\alpha}{d\ln L}\frac{d\ln L}{d\ln M}, \end{aligned} \tag{1.M.31}$$

where the short-cut $\omega = \frac{L}{H}\frac{\psi_\alpha b - b^{1-\epsilon} + \epsilon(1-b)\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}{\left[\frac{L}{H} + \left(1-\frac{L}{H}\right)b\right]\left[\frac{L}{H}\psi_\alpha + \left(1-\frac{L}{H}\right)b^{1-\epsilon}\right]}$. Note that

$$\epsilon - \omega = \frac{\frac{L}{H}\left[b^{1-\epsilon} - \psi_\alpha b\right] + \epsilon b\left[\frac{L}{H}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}\right]}{\left[\frac{L}{h} + \left(1 - \frac{L}{H}\right) b\right]\left[\frac{L}{h}\psi_\alpha + \left(1 - \frac{L}{H}\right) b^{1-\epsilon}\right]} \geq 0.$$

The term $\epsilon - \omega = 0$ if $\epsilon = 0$ or if $b = 0$ and $\epsilon - \omega > 0$ if $\epsilon > 0$ and if $b > 0$.

Thus, we can conclude (i) that an increase in the labor-capital-ratio reduces the wage, but this effect is mitigated by the factor $\epsilon\frac{|\lambda|}{\theta_T}\theta_{KT}$ due to the demand shift towards labor-intensive production if mean income falls; (ii) that an increase in labor productivity unambiguously reduces the wage in terms of efficiency units of labor since this reduces the

capital-labor-ratio in efficiency units and the higher average income involves a demand shift towards capital-intensive goods; (iii) that an increased labor-force participation rate reduces the wage for the same reasons; and (iv) that a higher equality in the distribution of labor productivity raises the wage level since this involves a higher share of labor intensive goods in consumption. Note that the demand-shift effects of migration are particularly large if the average labor productivity and the labor force participation rate falls and the tax-benefit system ensures a high level of income equality.

In the limiting case of an employment ban of the migrant population, equation (1.M.30) is reduced to

$$\frac{d\ln w}{d\ln M} = \frac{1}{\sigma}\left[\frac{|\lambda|}{\theta_T}(\epsilon-\omega)\right]\frac{d\ln H}{d\ln M},$$

which corresponds to equation (5) in the main text. Since in this case immigrants do not affect the capital-labor-ratio, average labor productivity and the dispersion of labor productivity of the employed workforce, only the demand effect of an increasing population remains. The expression on the right-hand side is positive if $\epsilon > 0$ and $b > 0$ if $\epsilon - \omega > 0$.

1.M.4 Employment Impact under Imperfect Labor Markets

According to the wage-setting approach outlined in the main text, wages decline with the unemployment rate, albeit imperfectly, such that the wage-setting function is given by $\phi(u)$ with $\phi' \leq 0$. Moreover, the main text distinguishes for analytical purposes between the non-participation in the labor force, which might be forced by an employment ban, and the unemployment rate as an outcome of an imperfect adjustment of wages to labor supply changes. Given the definition for the unemployment rate, $u \equiv 1 - \frac{L}{\bar{L}}$, where $\bar{L}$ is the total labor supply of households, the employment rate of the economy in terms of the labor force is given by $\frac{L}{\bar{L}}$ and in terms of the total population by $(1-u)\frac{\bar{L}}{H} = \frac{L}{H}$. Moreover, unemployment benefits are paid to both unemployed persons and non-participants in the labor force. Under these assumptions the expressions for $\bar{e}$ and ψ as well as for their log changes in equations (1.M.28) and (1.M.30) remain the same.

We can therefore rewrite the system as the implicit function

$$\Omega(L,M) = Y_L\left(\tilde{L}(L), \bar{e}(L,H(M), \psi(L,H(M),\right) - \phi\left(u(L,\bar{L}(H(M)))\right) = 0, \tag{1.M.32}$$

where we have ruled out the adjustment of the capital stock, i.e. considered the short-term case. Differentiating this for the log change in employment with respect to a log change in the number of households through migration delivers

$$\begin{aligned}\frac{d\ln L}{d\ln M} = &\left[\frac{d\ln Y_L}{d\ln \tilde{L}}\frac{d\ln \tilde{L}}{d\ln L} + \frac{d\ln Y_L}{d\ln \bar{e}}\frac{d\ln \bar{e}}{d\ln L} + \frac{d\ln Y_L}{d\ln \psi}\frac{d\ln \psi}{d\ln L} - \frac{d\ln \phi}{d\ln u}\frac{d\ln u}{d\ln L}\right]^{-1} \times \\ &\left[\frac{d\ln \phi}{d\ln u}\frac{d\ln u}{d\ln \bar{L}}\frac{d\ln \bar{L}}{d\ln H} - \frac{d\ln Y_L}{d\ln \bar{e}}\frac{d\ln \bar{e}}{d\ln H} - \frac{d\ln Y_L}{d\ln \psi}\frac{d\ln \psi}{d\ln H}\right]\frac{d\ln H}{d\ln M}.\end{aligned} \tag{1.M.33}$$

Substituting for the derivatives of Y_L with respect to the effective labor supply, $\tilde{L}$, mean income, $\bar{e}$ and the inverse inequality index, ψ, delivers equation (1.6) in the main text.

Using the decomposition of $d \ln \tilde{L}$, $d \ln \bar{e}$ and $d \ln \psi$ in equations (1.M.27), (1.M.28) and (1.M.30) yields after some rearranging equation (1.7) in the main text.

1.A Appendix: Background and Supporting Evidence

1.A.1 Labor Intensity of Tradable and Non-Tradable Sectors

TABLE 1.A1: LABOR INTENSITY INDICATORS OF INDUSTRIES IN GERMANY, 2021

	Value added per worker in EUROs	Capital stock per worker in EUROs	Ratio (%): wage sum/ value added
Tradable industries[1]	**94,170**	**410,366**	**58**
Of these:			
Agriculture, forestry, fishing	54,619	692,180	27
Producing industries w/o constr.	96,916	390,814	60
Non-tradable industries[2]	**58,631**	**302,023**	**68**
Of these:			
Construction	68,601	52,615	54
Trade, transport, restaurants & hotels	52,183	170,606	63
Information & communication	113,912	264,939	63
Finance	113,305	363,219	61
Business services	61,445	176,957	63
Public sector, education, health	53,652	307,821	82
Other services	38,430	174,349	63
Total	**80,074**	**319,663**	**59**

Notes: 1) Agriculture, forestry, fishing and all producing industries w/o construction. – 2) Construction and all service industries w/o real estate. The real estate sector is generally excluded since it covers large parts of the housing stock. *Source:* Statistisches Bundesamt (2022); the aggregation and calculations are our own.

1.A.2 Institutional Details of the Dispersal Policy

Assignment Quotas In Germany, the regional distribution of asylum seekers takes place in two steps: across federal states and within federal states to districts. After arriving the border, asylum seekers are first assigned to a federal state by the so-called "EASY" registration system, an algorithm that distributes applicants in real time.[37] Then, within each state, asylum seekers are immediately sent to an initial reception facility ("IRF", based on nationality, capacity, and distance) where they submit their asylum application. If their asylum claim is accepted, which can take several weeks or months, or if they have good prospects of being allowed to stay in Germany, asylum seekers are in a second step allocated within state across districts. The within-state distribution quotas differ between states: while all states assign quotas based on population size, several states also use

[37] The regional distribution is based on the population share and tax revenue of the states, i.e. the so-called "Königssteiner" key. Our state $\times$ time fixed effects absorb any variation that stems from this first distribution step.

additional characteristics to calculate their quotas (see Table 1.A2 for details). Notwithstanding, quotas differ across states and over time due to different base years (for the population numbers)[38] and different deduction rules (e.g. for districts with an IRF).

TABLE 1.A2: ASSIGNMENT RULES BY FEDERAL STATE

Federal state	Criteria for allocation key	Population data from
Baden-Württemberg	Population	Previous year
Bavaria	Population & Urban indicator	2006 (until 2016)
Berlin	*Not applicable bc. city state*	
Brandenburg	Population & Area & Share of employees liable to social security*	Previous year
Bremen	*Not applicable bc. city state*	
Hamburg	*Not applicable bc. city state*	
Hesse	Population & Large share of foreigners indicator	Previous year 30.06.
Mecklenburg-West Pomerania	Population	Previous year 31.12.
Lower Saxony	Population	Unspecified
North Rhine-Westphalia	Population & Area	Unspecified
Rhineland Palatinate	Population	Two years ago 31.12.
Saarland	Population	Considers deviations
Saxony	Population	Previous year 30.06.
Saxony-Anhalt	Population	Half-yearly 15.01.&15.07.
Schleswig-Holstein	Population	Previous year 30.03.
Thuringia	Population	Unspecified

Source: Own collection of federal state legislation.
* Brandenburg is excluded from the main regressions due to the inclusion of potentially endogenous criteria in the quota.

Initial Reception Facilities (IRF) The federal states are obliged by federal law (§44(1) AsylG) to grant all incoming refugees a place in an initial reception facility run by the federal state. Prior to 2015, most federal states had only one initial reception facility ("Erstaufnahmeeinrichtungen"), but during the large inflow in 2015, new ones were opened quickly. The choice of location for new initial reception facilities was made under pressure and governed by the availability of large unused buildings or facilities that could accommodate a large number of refugees, often unused military facilities. These include Ellwangen, Sigmaringen, Mannheim and Schwetzingen in Baden-Württemberg. Oldenburg in Lower-Saxony was a former military hospital.

Legally, asylum seekers can be obliged to stay in a reception facility while their asylum requests are filed and processed for up to 18 months for adults or up to 6 months for families with minors.[39] In practice however, the time asylum seekers spend in reception centers varies strongly, and in many cases asylum seekers had to leave the reception centers before a decision had been made on their cases or even before they were able to submit their application in order to free scarce capacities for new arrivals. In Lower Saxony, the state government decided to try to accommodate refugees longer in initial reception facilities to provide the districts with time to prepare for the large amount of

[38] Some federal states update their quotas every year.
[39] §47(1) AsylG

refugees for which they are responsible. To do this, the capacities in initial reception facilities changed by a factor of 18 (Oct. 2015 relative to the the first half year of 2015; see Gedaschko, Götz, Griesbeck, Meier, Meyer, Oltmer, Richert, Selbach & Rudolf, 2016).

1.A.3 Potential Endogeneity Issues in the Regional Allocation of Refugees

Deviations from the dispersal policy have likely occurred for four reasons. On one the hand, local authorities were overwhelmed by the sheer number of arrivals and had to take pragmatic decisions to avoid homelessness and sent new incomers to any places where housing was still available. This led at least in the short run to disproportionally more asylum seekers being assigned to areas with large vacant premises and cheap rents.[40] Table 1.1 supports this argument in our datasets and shows that these were regions with high unemployment rates and predominantly rural regions. In addition, a substantial share of asylum seekers did not arrive at the places they originally had been assigned to (for instance because they preferred to continue their journey and apply for asylum at another place).[41] This attrition is another risk of endogenous location choice. Third, some cities lobbied for hosting more refugees than stipulated, such as Cottbus, Goslar and Hettstedt, while others aimed at hosting fewer refugees, e.g. Göttingen.[42] Finally, there is likely a non-random measurement error in the central registry of foreigners data set ("Ausländerzentralregister", AZR). It is documented that in late 2015, the total number of asylum seekers was systematically under-reported[43] because local authorities worked at their limits at the time and had other priorities than reporting numbers to the register. In order to account for these four issues, we argue that the use of instrumental variables for consistent causal estimates of the regional effects of the recent refugee immigration in Germany is inevitable.

1.A.4 Cost Refund for Asylum Seeker Expenses

While the costs for the asylum procedures are directly covered by the federal government, expenses for the accommodation of refugees are first borne by the district (or community) and then refunded by the federal state. This way, local expenditures on asylum seekers do not depend on the financial conditions of local authorities. Policy makers frequently emphasized that the additional spending on the integration of refugees (Table 1.A3) could be covered by an unexpected surplus of the federal government budget so that neither did expenditures in other sectors have to be cut nor did debts have to be taken up as a response to the arrival of asylum seekers.[44] Social benefit expenditures for

[40] See, for instance, Brücker, Hauptmann & Jaschke, 2020.
[41] Some authorities we talked to mention attrition rates of about 20%.
[42] Weblinks last retrieved 13.9.2022.
[43] See Statistisches Bundesamt (2020a, p.11), and Statistisches Bundesamt (2020b, p.15).
[44] In fact, there were plans to use unexpected surplus to repay government debt.

TABLE 1.A3: FEDERAL BUDGET ON REFUGEES (IN BILLION EUROS)

	2016	2017	2018
Registration and accommodation during procedure	1.14	1.02	1.02
Integration efforts	1.80	3.11	3.72
Social transfers after procedure	1.71	2.68	3.29
Transfers to states and municipalities	9.26	6.78	6.81
Sum	**13.91**	**13.59**	**14.84**

Source: Deutscher Bundestag (2017, Table 6, p. 36)

asylum seekers accrue *per capita* and therefore depend directly on the number of asylum seekers in a district.[45]

The refunding of costs is implemented by means of a lump sum (or flat rate), a reimbursement or a combination of both. Comparisons across federal states are complicated by the fact that different types of costs are considered and the administrative details vary (Wendel, 2014). In federal states with a lump sum, the level per asylum applicant per year varied in 2014 from nearly 6,000 euros (in Rhineland-Palatinate and Lower Saxony) to about 9,000 euros (in Brandenburg; ibid., p. 26 f.). This money is meant to cover the district costs for housing, other infrastructure and support and social benefits for asylum seekers. Additional transfers from the federal government can support districts in caring for unaccompanied minors, creating new child care facilities and in the construction of new housing (Bundesregierung, 2017).[46]

1.A.5 Data Appendix

This appendix provides further details on the data. Our empirical analysis is on the district level. A few of the 401 German districts share a common immigration authority and therefore do not report the number of residing foreigners separately. In this case we have merged several districts for our analysis. This is the case for (1) the entire state of the Saarland; (2) Stadt and Landkreis Kassel; (3) Stadt Cottbus and Spree-Neiße Kreis; and (4) Lankreis Göttingen and Landkreis Osterrode im Harz. In addition we dropped the state of Brandenburg from our analysis because it distributes asylum seekers based on regional employment. These restrictions leave us with data on 377 districts.

From the AZR data set, we include the following residence status levels for asylum seekers: (1) Foreign nationals who expressed their wish to seek asylum at the border but have not yet formally filed an asylum application (*"Asylgesuch gestellt"*); (2) Foreigners whose asylum application is still processed (*"Aufenthaltsgestattung"*); (3) Refugees who have a residence permit because their asylum application has been (at least temporarily) accepted (*"Aufenthaltserlaubnis aus völkerrechtlichen, humanitären oder politischen*

[45] State policies also differ with respect to how much of the benefits is paid in cash or in kind. In particular, there is a large variation between states in the share of asylum seekers living in decentralized apartments and that receive almost exclusively cash payments. In 2013, they ranged from 34% in Baden-Württemberg up to 90% in Rhineland-Palatinate.

[46] While data on cost recovery are hard to obtain, the example of the federal state of Thuringia for the year 2012 shows a substantial variation across districts with cost recovery varying by district between 46% and 104% (ibid., p. 30f.)

Gründen"); (4) Foreign nationals whose asylum application has been rejected but who are tolerated in Germany because they cannot be deported (*"Duldung"*); and (5) Foreign nationals without any formal residence status if they possess the nationality of one of the eight most frequent asylum seeker countries of origin (Afghanistan, Eritrea, Iraq, Iran, Nigeria, Pakistan, Somalia, Syria).

1.A.6 Additional Figures and Tables

TABLE 1.A4: CHARACTERISTICS OF ECONOMIC SECTORS

Sector	Employment	Annual growth (%)
Tradable sectors		
Agriculture, Mining, Energy, Water	781,839	-2.67
Manufacturing	6,472,069	0.89
Non-tradable sectors		
Construction	1,693,763	1.953
Wholesale/Retail Trade	4,170,470	1.57
Transportation and Storage	1,551,716	3.27
Accomodation and Food Services	938,367	4.20
Information and Communication	924,838	3.54
Finance, Insurance, Real Estate	1,226,697	0.09
Scientific and Technical Services	1,925,461	3.55
Other Commercial Services	1,233,937	4.82
Temporary Agency Work	791,861	3.99
Public Administration	1,700,185	1.14
Education	1,156,119	2.54
Human Health	2,251,308	2.02
Social Sector	2,001,573	4.31
Other Personal Services	1,120,917	1.25
Total Employment	**29,941,120**	**2.07**

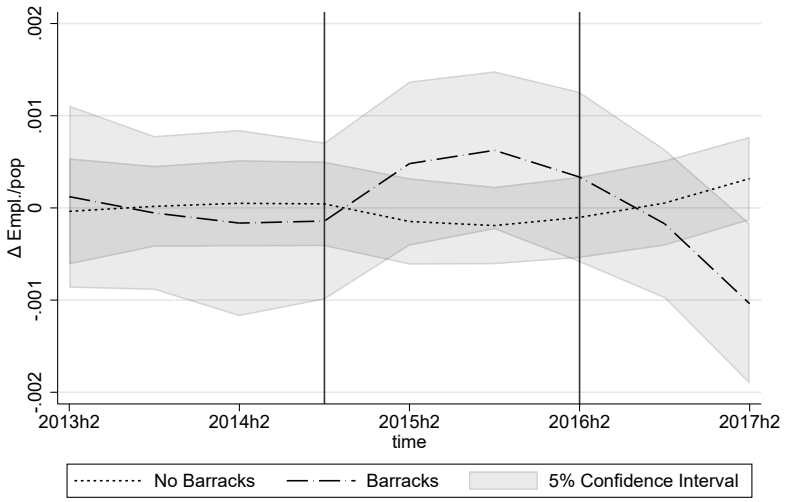
Note: Total number of people employed subject to social security contributions in June 2014. Annual employment growth is averaged over the years 2014-2016.

TABLE 1.A5: BALANCING TABLE: DISTRICTS WITH VACANT MILITARY BASES

	Military base (mean)	No military base (mean)	Difference (b)	(t)
Population	265,244	195,473	69,772*	(1.80)
Urban region (%)	56.43	46.68	9.75	(0.94)
AS without lm access /1000pop	0.71	0.65	0.06	(0.40)
AS with lm access /1000pop	4.90	4.46	0.44	(0.64)
Percentage foreign employment	8.14	7.56	0.58	(0.57)
Percentage high-skilled empl.	13.43	12.15	1.28	(0.72)
Percentage empl. in non-trad. sect.	75.72	73.98	1.74	(0.95)
Unemployment rate	6.76	6.85	-0.09	(-0.16)
Δ Emp/1000pop (All sectors)	4.99	4.37	0.62	(0.66)
Δ Emp/1000pop (Non-tradables)	4.66	4.05	0.60	(0.72)
Δ Emp/1000pop (Tradables)	0.15	0.28	-0.13	(-0.99)
Δ Emp/1000pop (Foreigners)	0.002	0.002	0.0002	(0.45)
Δ Emp/1000pop (High skilled)	0.004	0.003	0.0005	(0.56)
Δ Unemp/1000pop (Total)	0.62	0.42	0.19	(0.71)
Observations	69	308	377	

Notes: The distinction is whether a district has a vacant military base available. The covariates are measured in 2013h2. All variables are weighted by population in working age. Robust T-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

FIGURE 1.A1: LABOR MARKET TRENDS IN DISTRICTS WITH VACANT MILITARY BASES



Notes: The labor market outcomes are measured in yearly differences and normalized by population excluding refugees in the baseyear 2013. District and time x state fixed effects are controlled for.

TABLE 1.A6: BASELINE RESULTS (DIFFERENT INSTRUMENT COMBINATIONS)

	IV (1)	IV (2)	IV (3)
Outcome: Δ Total employment/pop			
Δ AS /pop	0.63*	0.34*	0.42**
	(0.35)	(0.20)	(0.20)
Observations	2,639	2,639	2,639
Outcome: Δ Employment non-tradable/pop sectors			
Δ AS /pop	1.00**	0.35*	0.53***
	(0.44)	(0.20)	(0.19)
Observations	2,639	2,639	2,639
Outcome: Δ Employment tradable sectors/pop			
Δ AS /pop	-0.38	-0.05	-0.14
	(0.30)	(0.08)	(0.10)
Observations	2,639	2,639	2,639
Outcome: Δ Unemployment/pop			
Δ AS /pop	-0.34*	-0.19*	-0.23***
	(0.19)	(0.10)	(0.09)
Observations	2,639	2,639	2,639
Time × state FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
IV 1: Barracks	×		×
IV 2: Quota assignments		×	×
Effective F-stat	5.93	14.1	10.01
Crit. value 5% bias	*37.42*	*37.42*	*8.56*
Crit. value 20% bias	*15.06*	*15.06*	*4.75*

Notes: All variables are expressed in yearly differences and normalized by population excluding refugees in the base year 2013. All regressions are weighted with working-age population. The coefficients shown are for asylum seekers without labor market access. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 1.A7: EFFECTS ON COMMUTER FLOWS

	(1) Inflows	(2) Outflows	(3) Netflows
Δ AS/pop	0.12	-0.0004	0.12
	(0.08)	(0.06)	(0.10)
Time × State FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Observations	2,639	2,639	2,639

Notes: Standard errors are clustered on the level of districts and displayed in parentheses. Refugee inflow is expressed in yearly differences and normalized by population excluding refugees in the base year 2013. All regressions are weighted with the normalizing variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the quotas and barracks as instruments. The commuter numbers are only available on a yearly basis (30 June of each year) and are linearly interpolated for the December data points.

TABLE 1.A8: MEDIUM-RUN EFFECTS BY POPULATION SUBGROUPS

	Employment Time window			Unemployment Time window		
	1 year (1)	2 years (2)	3 years (3)	1 year (4)	2 years (5)	3 years (6)
			Total population			
Total	0.42**	0.32*	0.15	-0.23***	-0.10	-0.10
	(0.20)	(0.19)	(0.18)	(0.09)	(0.08)	(0.08)
			By gender			
Male	0.19	0.20	-0.03	-0.14**	-0.06	-0.03
	(0.12)	(0.13)	(0.13)	(0.05)	(0.05)	(0.05)
Female	0.23**	0.13*	0.00	-0.09**	-0.04	-0.07*
	(0.09)	(0.07)	(0.09)	(0.04)	(0.04)	(0.04)
			By education			
No degree	0.12**	0.03	-0.01	-0.15**	-0.06	-0.02
	(0.05)	(0.06)	(0.06)	(0.07)	(0.06)	(0.05)
Vocational degree	0.13	0.06	-0.22**	-0.03	0.03	0.01
	(0.10)	(0.09)	(0.10)	(0.04)	(0.04)	(0.03)
Academic degree	0.17**	0.21**	0.23**	-0.04***	-0.02	-0.02**
	(0.08)	(0.10)	(0.11)	(0.01)	(0.01)	(0.01)
			By nationality			
Germans	0.36**	0.26*	0.16	-0.12**	-0.04	-0.05
	(0.16)	(0.16)	(0.17)	(0.05)	(0.05)	(0.05)
Foreigners	0.06	0.06	-0.02	-0.11**	-0.06	-0.05
	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)	(0.04)
Asylum countries	0.00	0.03	0.05**			
	(0.01)	(0.02)	(0.02)			

Notes: All variables are normalized by population excluding refugees. All regressions are weighted with the normalizing variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the quotas and barracks as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 1.A9: MAIN RESULTS WITH DIFFERENT SETS OF FIXED EFFECTS

	(1)	(2)	(3)
Outcome: Δ Total employment/pop			
Δ AS /pop	0.42**	0.25***	0.33**
	(0.20)	(0.08)	(0.14)
Observations	2,639	2,639	2,639
Outcome: Δ Employment non-tradable sectors/pop			
Δ AS /pop	0.53***	0.21**	0.29**
	(0.19)	(0.09)	(0.14)
Observations	2,639	2,639	2,639
Outcome: Δ Employment tradable sectors/pop			
Δ AS /pop	-0.14	0.01	-0.01
	(0.10)	(0.06)	(0.06)
Observations	2,639	2,639	2,639
Outcome: Δ Unemployment/pop			
Δ AS /pop	-0.23***	0.04	0.06
	(0.09)	(0.04)	(0.04)
Observations	2,639	2,639	2,639
Observations	2,639	2,639	2,639
Effective F-stat	10.01	45.56	49.61
Crit. value 5% bias	*8.56*	*25.93*	*26.63*
Crit. value 20% bias	*4.75*	*10.94*	*11.2*
District FE	Yes	Yes	No
Time × state FE	Yes	No	No

Notes: The estimation is based on equation (1.12): All variables are expressed in yearly differences and normalized by population size excluding asylum seekers in the base year 2013. All regressions are weighted with the normalizing variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 1.A10: CONTROLLING FOR OTHER IMMIGRANT GROUPS

	(1)	(2)
Outcome: Δ Total employment/pop		
Δ AS without lm access /pop	0.42**	0.44**
	(0.20)	(0.20)
Δ AS with lm access		0.12
		(0.08)
Δ Foreigners excl. AS/pop		0.06**
		(0.03)
Observations	2,639	2,639
Outcome: Δ Employment non-tradable sectors/pop		
Δ AS without lm access /pop	0.53***	0.57***
	(0.19)	(0.20)
Δ AS with lm access		0.22**
		(0.09)
Δ Foreigners excl. AS/pop		0.06**
		(0.03)
Observations	2,639	2,639
Outcome: Δ Employment tradable sectors/pop		
Δ AS without lm access /pop	-0.14	-0.16
	(0.10)	(0.10)
Δ AS with lm access		-0.10*
		(0.05)
Δ Foreigners excl. AS/pop		-0.00
		(0.01)
Observations	2,639	2,639
Outcome: Δ Unemployment/pop		
Δ AS without lm access /pop	-0.23***	-0.23***
	(0.09)	(0.09)
Δ AS with lm access		-0.02
		(0.03)
Δ Foreigners excl. AS/pop		-0.00
		(0.01)
Observations	2,639	2,639
Effective F-stat	10.01	9.54
Crit. value 5% bias	*8.56*	*8.65*
Crit. value 20% bias	*4.75*	*4.79*
Time × state FE	×	×
District FE	×	×

Notes: All variables are expressed in yearly differences and normalized by population excluding refugees in the base year 2013. All regressions are weighted with the normalization variable. The coefficients shown are for asylum seekers without labor market access. All regressions are IV estimations including the barracks and quotas as instruments. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

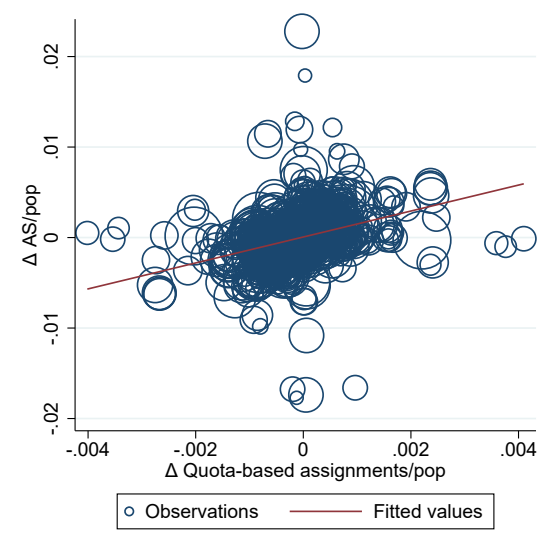
TABLE 1.A11: ROBUSTNESS CHECKS

	(1) Baseline	(2) Excl. 2017	(3) No IRFs	(4) incl. BB	(5) excl. BB+HE	(6) altern. IV
Outcome: Δ Total employment/pop						
Δ AS /pop	0.42**	0.37*	0.54	0.38*	0.44**	0.39*
	(0.20)	(0.20)	(0.51)	(0.19)	(0.22)	(0.21)
Observations	2,639	1,885	2,328	2,758	2,443	2,639
Outcome: Δ Employment non-tradable sectors/pop						
Δ AS /pop	0.53***	0.43**	0.94	0.48**	0.56**	0.43**
	(0.19)	(0.19)	(0.58)	(0.19)	(0.22)	(0.21)
Observations	2,639	1,885	2,328	2,758	2,443	2,639
Outcome: Δ Employment tradable sectors/pop						
Δ AS /pop	-0.14	-0.09	-0.41	-0.13	-0.15	-0.07
	(0.10)	(0.09)	(0.28)	(0.09)	(0.10)	(0.09)
Observations	2,639	1,885	2,328	2,758	2,443	2,639
Outcome: Δ Unemployment/pop						
Δ AS /pop	-0.23***	-0.24***	-0.55	-0.23***	-0.25**	-0.22**
	(0.09)	(0.09)	(0.41)	(0.08)	(0.10)	(0.09)
Observations	2,639	1,885	2,328	2,758	2,464	2,639
Including Year 2017	×		×	×	×	×
Including IRFs	×	×		×	×	×
Including Brandenburg				×		
Including Hesse	×	×	×	×		×
IV: Quota-assignment	×	×	×	×	×	×
IV: Vacant milit. bases	×	×	×	×	×	
IV: Bases vacant > 5 years						×
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Time × state FE	Yes	Yes	Yes	Yes	Yes	Yes
Effective F-stat	10.01	11.49	13.68	10.79	8.23	10.22
Crit. value 5% bias	*8.56*	*19.58*	*29.39*	*9.06*	*7.61*	*19.79*
Crit. value 20% bias	*4.75*	*8.67*	*12.18*	*4.93*	*4.42*	*8.72*

Notes: The estimation is based on equation (1.12). All variables are expressed in yearly differences and normalized by population excluding asylum seekers in the base year 2013. All regressions are weighted with with the normalizing variable. The coefficients shown are for asylum seekers without labor market access. Standard errors clustered on the district level in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

FIGURE 1.A2: SCATTER PLOTS OF VARIATION

(A) FIRST STAGE



(B) SECOND STAGE

Notes: Variables are normalized with population excluding refugees in the base year 2013 and net of district and state × time fixed effects. The x-axis of Sub-figure (b) depicts the outcomes of the first stage. The sample consists of half-yearly data 2014h2-2017h2. Data points are weighted with the population in the base year (excluding refugees).

Chapter 2

Early Industrialization and Regional Development

Joint work with Sebastian T. Braun and Richard Franke

Slightly modified versions of this chapter have been circulated as discussion papers under the title "Reversing Fortunes of German Regions, 1926–2019: Boon and Bane of Early Industrialization?" (Berbée, Braun & Franke, 2022a,b).

My individual contribution within the coauthors' team includes: Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Data curation, Writing – Review & Editing, Visualization. (Contributor Role Taxonomy, CRediT, see Brand et al., 2015)

2.1 Introduction

Regional per capita income within advanced economics converged during much of the 20th century (e.g. Barro & Sala-i Martin, 1991; Sala-i Martin, 1996; Persson, 1997). However, there is growing evidence that convergence ended around 1980. Since then, regional disparities have increased again (e.g. Rosés & Wolf, 2018a; Gaubert et al., 2021). This "return of regional inequality" (Rosés & Wolf, 2018b) contributes to growing income inequality and might endanger social cohesion and political stability (Iammarino, Rodriguez-Pose & Storper, 2018; Floerkemeier, Spatafora & Venables, 2021). Of particular concern are declining regions, with their lack of economic opportunity, growing social problems, and rising political tensions (Austin, Glaeser & Summers, 2018; Rodríguez-Pose, 2018). What many of these declining regions have in common is that they had a high share of industrial jobs in the past and are now suffering from the dislocation of deindustrialization (Rosés & Wolf, 2021).

Against this background, the contribution of this paper is two-fold. First, we provide a detailed descriptive analysis of the spatial distribution of economic activity in West Germany over the period 1926-2019. Using a novel data set for 163 labor markets, we study the rise and decline of German regions over the past century and explore trends in regional income inequality. Second, we quantify the effect that early industrialization, measured as the industrial employment share in 1882, had on spatial economic development over time. We then use these results to quantify to what degree regional differences in the early stages of industrialization can explain the changing fortunes of West German labor markets over the past century.

West Germany witnessed a marked reversal of fortune in the 20th century: Historically, North-western Germany was more prosperous than the South. However, the economic balance of power reversed after the Second World War, and today, the North considerably lags behind the South.[1] This reversal makes Germany a particularly interesting case for studying the historical drivers of regional economic decline. After all, economic historians have long argued that the decline of North-western Germany, and particularly the Ruhr region, can be traced back to regional differences in 19th-century industrialization (Abelshauser, 1984; Nonn, 2001; Kiesewetter, 1986).

According to this argument, the reliance of the North on large-scale, capital-intensive firms—often in heavy industries, such as coal, iron, and steel—was conducive to economic development only until the mid-20th century. The heavy industry in the North plunged into crisis after World War II and deindustrialization has impeded economic growth ever since. The most visible signs of decline have been the crisis in the coal industry since 1957, in shipbuilding since the 1960s, and the steel crisis in the 1970s. This paper tests the hypothesis that early industrialization was first conducive and later detrimental for economic development and explores the implications for the marked changes

[1] Appendix Figure 2.A1 shows the steady relative economic decline of North Germany since 1950. At that time, per capita GDP was about 15% higher in the North than in the South. This lead had vanished by 1980. The past four decades saw a widening gap between South and North Germany. Currently, income per capita is more than 10% lower in the North than in the South.

in Germany's economic geography observed in recent decades.

We present three key findings. First, we show that about half of West German labor markets experienced a reversal of fortune between 1926 and 2019, i.e., they moved from the lower to the upper median of the income distribution or vice versa. Economic decline is concentrated in the North: Two-thirds of northern labor markets with above-median per capita incomes in 1926 have below-median income today. We also show that β-convergence ended in 1992. Regional income inequality has increased moderately since 1980, after a sharp decline in the post-war era.

Second, we show that early industrialization after World War II turned from an advantage for economic development to a burden. To establish causality, we instrument a region's industrial employment share in 1882 by its weighted least-cost distance to European coalfields, while controlling for a region's connectedness to other European markets. We exploit the fact that heavy industries, characteristic of Germany's early industrialization process, were dependent on access to coal (Gutberlet, 2014; Ziegler, 2012). Coal, in turn, is found in Carboniferous rock strata, formed hundreds of millions of years ago. Distance to coalfields is thus plausibly exogenous to economic development (Fernihough & O'Rourke, 2020). Our 2SLS estimates suggest that a one standard deviation increase in the 1882 industry employment share increases a labor market's rank in the income distribution by 16.8 percentiles in 1957, but decreases the rank by 14.3 percentiles in 2019. We present evidence consistent with the hypothesis that the dominant local position of heavy industry constrained regional adaptive capacity and innovation while generating high adjustment pressure since 1957.

Third, we show that regional differences in 19th-century industrialization are indeed crucial for understanding the reversing fortunes of West German labor markets in recent decades. We quantify the contribution of early industrialization to the North-South gap by predicting the gap for a counterfactual scenario in which regions differ only by their 1882 industrial employment share. Our estimates imply that regional differences in early industrialization can account for almost half of the current North-South gap in per capita income. To quantify the contribution of early industrialization to the evolution in regional inequality, we measure the inequality of a counterfactual income distribution in which all regions are assigned the mean 1882 industrial employment share. We find that the declining positive impact of early industrialization explains well over half of the decline in regional inequality from 1957 to 1980.

Contribution to literature. Our paper contributes to several literature strands. First, we provide new descriptive insights into the evolution of regional economic activity in Germany. Our analysis of 163 labour markets complements previous work on regional development in Germany, conducted at higher aggregation levels (e.g., Kaelble & Hohls, 1989; Frank, 1993; Kiesewetter, 2004). Most closely related to our work is a recent study by Wolf (2018) that describes regional economic development in Germany over the period 1895–2010. The author constructs GDP per capita data for 36 (East and West) German NUTS-2 regions in their 1990s boundaries. We add to Wolf (2018) by presenting evidence

for West Germany at a more disaggregated level. In addition, we place a specific focus on transitions between quartiles of the income distribution.

Second, we contribute to an emerging literature that examines the long-term consequences of early industrialization. Franck & Galor (2021) demonstrate that early industrialization has adverse effects on regional economic development in 21st-century France, and Esposito & Abramson (2021) show that former coal-mining regions in Europe have lower GDP per capita today than regions where coal was not previously mined.[2] Both papers attribute the negative long-term effects to adverse consequences for human capital formation.

Our study confirms that early industrialization has negative long-term effects in Germany, where heavy industry played a crucial role in the development process. In contrast to Esposito & Abramson (2021) and Franck & Galor (2021), we find no evidence that early industrialization hindered human capital formation in the long run. This may be because the "educational expansion" of the 1960s and 1970s counteracted the de-skilling effect of early industrialization by establishing new universities in West Germany's industrial heartland. Instead, our results suggest that early industrialization became a drag on economic development because of its negative impact on local innovation and adaptive capacity. The dominant position of large-scale corporations, embedded in a supportive system of corporate relations, preserved local economic structures in an early phase of decline (Grabher, 1993). Today, the old industrial core lacks industry, which in Germany is generally more productive and innovative than the service sector.

Third, we contribute to the ongoing debate on the drivers of the fundamental changes in regional disparities that many advanced economies have experienced in recent decades (Rosés & Wolf, 2018a; Floerkemeier et al., 2021). Our analysis relates the time-varying effects of early industrialization to the marked changes in German economic geography. We show that the decaying effects of early industrialization can explain much of the decline in regional income inequality in the 1960s and 1970s. Similarly, the economic decline of northern Germany is closely related to the legacy of early industrialization. We conclude that differences in 19th-century industrialization are an important determinant of recent shifts in regional economic inequality that have received much public attention.

2.2 Data

Unit of analysis. Our unit of analysis is the 163 West German labor markets defined in IfW (1974) based on commuting flows.[3] We aggregate our source data, collected at the level of counties (*Kreise*), to the level of labor markets using Geographical Information

[2] Likewise, Matheis (2016) documents negative long-term effects of coal production on the population of US counties. For Western Europe, Rosés & Wolf (2021) document that proximity to coals turns into a burden after the end of the 1970s.

[3] To the best of our knowledge, the definition in IfW (1974) is the earliest available for West Germany. We exclude the Saarland from our sample, as it did not become part of postwar West Germany until 1957.

System (GIS) software.[4] The fact that we focus on local labor markets rather than counties has two advantages. First, where people live and work often differs at the county level, which poses problems in ranking counties based on their per capita income. In contrast, most people live and work within the same local labor market. Second, territorial reforms led to a sharp decrease in the number of West German counties, especially in the 1970s, making the conversion of data in historical to current county boundaries prone to error. A common reform was to merge urban counties (*Stadtkreise*) with their surrounding rural counties (*Landkreise*). Such reforms do not pose problems at the level of local labor markets, as the latter encompass interconnected rural and urban counties.

GDP per capita, 1926-2019. Our main outcome variable is a labor market's percentile rank in the income distribution of West German labor markets. West Germany's federal statistical office began publishing disaggregated GDP per capita data at the county level in 1957. We digitized the data for 1957-1992 from printed sources. Data are available for eleven years in this period, namely for 1957, 1961, 1964, 1966, 1968, 1970, 1972, 1974, 1978, 1980 and 1992. GDP data for 1992-2019 are available at an annual frequency in electronic form (Arbeitskreis VGR der Länder, 2021). We proxy regional GDP before 1957 by firm sales, as in, e.g., Vonyó (2012) or Peters (2022). Although firm sales are not a direct measure of the production value, they correlate strongly with local GDP and deliver similar income rankings.[5] We also present evidence for the sub-period 1957-2019, for which income ranks are based on GDP per capita data only.

Industrial employment share 1882. Our main explanatory variable of interest is the share of the local workforce working in industrial occupations in 1882. We thus measure industrialization after Germany's take-off phase, typically dated to 1840-1870s, but before the rise of new industries during Germany's *Hochindustrialisierung* (Ziegler, 2012; Tilly & Kopsidis, 2020). Our measure comes from the first German-wide occupation census that contains results at the county level (Kaiserliches Statististisches Amt, 1884). In a robustness check, we focus only on industrial occupations that have been identified as pivotal for Germany's industrial take-off, namely those in coal mining, iron and metal processing, construction of machines and instruments, and the textile industry.

Distance to European coal fields. Our empirical analysis uses an instrumental variable strategy to identify the causal effect of early industrialization on development. We use the weighted least-cost distance to European coalfields as an instrument for the 1882 employment share in industrial occupations. Access to coal is widely acknowledged as a key factor behind the success of Germany's early industrializing regions, which relied mainly on heavy industries (Fremdling, 1977; Ziegler, 2012). Fernihough & O'Rourke

[4] The definition of local labor markets is based on county boundaries in 1966. For other years, we overlay maps of historical county boundaries with the base map of local labor markets. We then use the proportion of each historical county's area that belongs to a particular local labor market to aggregate the county-level data.

[5] The correlation coefficient between a labor market's percentile rank in the 1955 sales per capita and the 1957 GDP per capita distribution is 0.870.

(2020) have recently demonstrated the importance of coal for the European Industrial Revolution in general.

Previous studies have used the proximity to the nearest coal-bearing rock strata as an instrument for the historical use of steam engines (de Pleijt, Nuvolari & Weisdorf, 2020) and coal mining (Esposito & Abramson, 2021). In contrast to these papers, we use the weighted least coast distance to all European coalfields to account for the fact that the closest coalfield is not necessarily the one that can be reached with the lowest transportation costs. This modification is important for the German context. In particular, regions in northern and northeastern Germany initially relied primarily on British coal, rather than coal from closer German mines, because of the low cost of river and sea transportation (Fremdling, 1979).[6]

To calculate the instrumental variable, we first divide Europe in a one-by-one kilometer grid. Based on the local geography, we assign each cell a specific transportation cost, which we take from Daudin (2010). We normalize the cost to one for cells that have access to the sea. Cells with access to a major river are assigned a cost value of 1.018, all other cells are assigned Daudin's value for road transport of 2.963.[7] We then calculate the least-cost distance from each labor market to all European coalfields, using the grid as cost surface. The algorithm finds the least-cost path from a region to a coalfield, adding cell-specific costs along the way. The instrument for a given labor market i, C_i, is the sum of the least-cost distances to all coalfields, using the area of coalfields as weights:

$$C_i = \sum_{k=1}^{K} \frac{area_k}{cost_{ik}}, \tag{2.1}$$

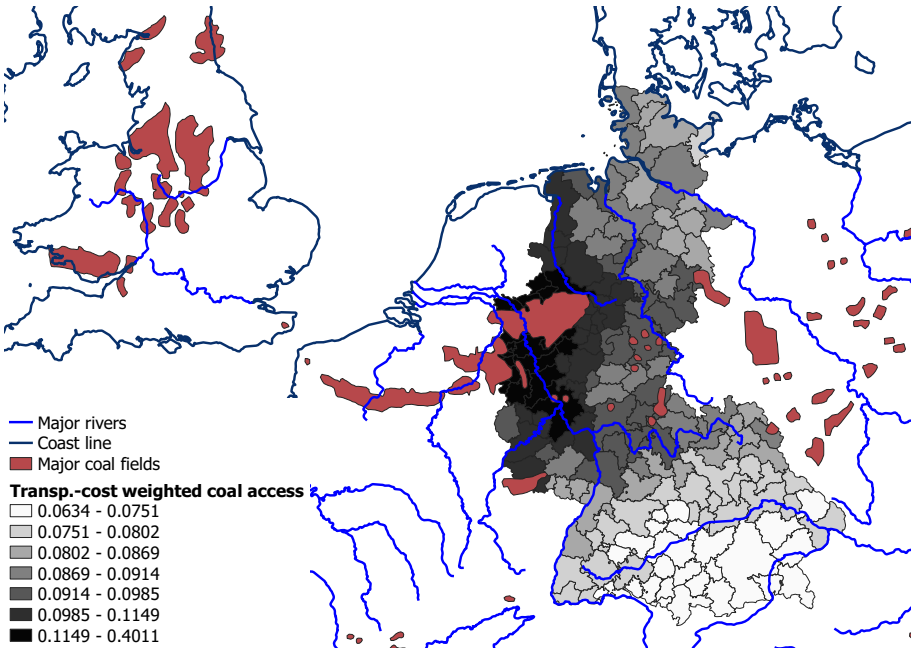
where $cost_{ik}$ is the least cumulative costs from labor market i to coalfield k and $area_k$ is the area of the coalfield polygon in square kilometers. We take the location and extent of European coalfields from Fernihough & O'Rourke (2020).

Figure 2.1 illustrates the regional variation in the instrument as well as the location of the most important coalfields, coast lines, and major rivers. Higher values indicate more favorable access to coal. Not surprisingly, access is most favorable in the Ruhr region and in regions connected to the Ruhr by rivers. Regions in northern Germany also have relatively favorable access to coal because they can obtain British coal via the North Sea. To ensure that the instrument does not just pick up the connectedness of a labor market within Europe, our empirical analysis controls for a labor market's sum of least-cost distances to all European grid cells on land using the same cost vector as in equation (2.1) (see Section 2.4 for details on the empirical specification).

[6] The relatively low price of English coal in northern Germany was also due to lower production costs in English mines, but this is not accounted for by our instrument.

[7] We take shape files of major European rivers from Fernihough & O'Rourke (2020). The value for rivers is the average of upstream and downstream river transport. We also probe the robustness of our results to alternative costs vectors. In particular, we use squared transport costs and assign higher costs of 2.476 to river and 9.75 to road transport, respectively, following Bairoch (1990). We also restrict the set of rivers to those that are at least 20 meters wide and two meters deep in an additional robustness check.

FIGURE 2.1: WEIGHTED LEAST-COST DISTANCE TO EUROPEAN COAL-FIELDS



Note: See the main text for details on the construction of the weighted least-cost distance. The transport cost vector is taken from Daudin (2010).

2.3 The Evolution of Regional per Capita Income, 1926-2019

Shifts in the relative position of labor markets. Table 2.1 documents marked changes in the relative position of West German labor markets over the past 100 years or so. It shows the transitions between quartiles of the income distribution from 1926 to 2019. Change is abound: more than half of the labor markets that were in the bottom quartile of the income distribution in 1926 are now in the top half of the distribution. Conversely, half of the richest labor markets in 1926 are now in the bottom half of the distribution (and 20% of them are even in the bottom quartile). Overall, about half of West German labor markets have experienced a reversal of fortune, i.e., they have moved from the lower to the upper median of the income distribution or vice versa.[8] The correlation between income ranks in 1926 and 2019 is only weakly positive at 0.100 and not statistically significantly different from zero.

The maps in Figure 2.2 illustrate how the economic weights within West Germany have shifted over time. For each West German labor market, the maps show its quartile rank in the income distribution in 1926, 1957, and 2019. In 1926, the economic powerhouses are scattered across the country. They are mainly concentrated in the metropolitan areas in the west (Rhineland, Ruhr region) and north (Bremen, Hamburg). But there are also clusters of rich labor markets in the south, e.g. around Stuttgart or Munich. Poorer labor markets are concentrated in the southeast of West Germany.

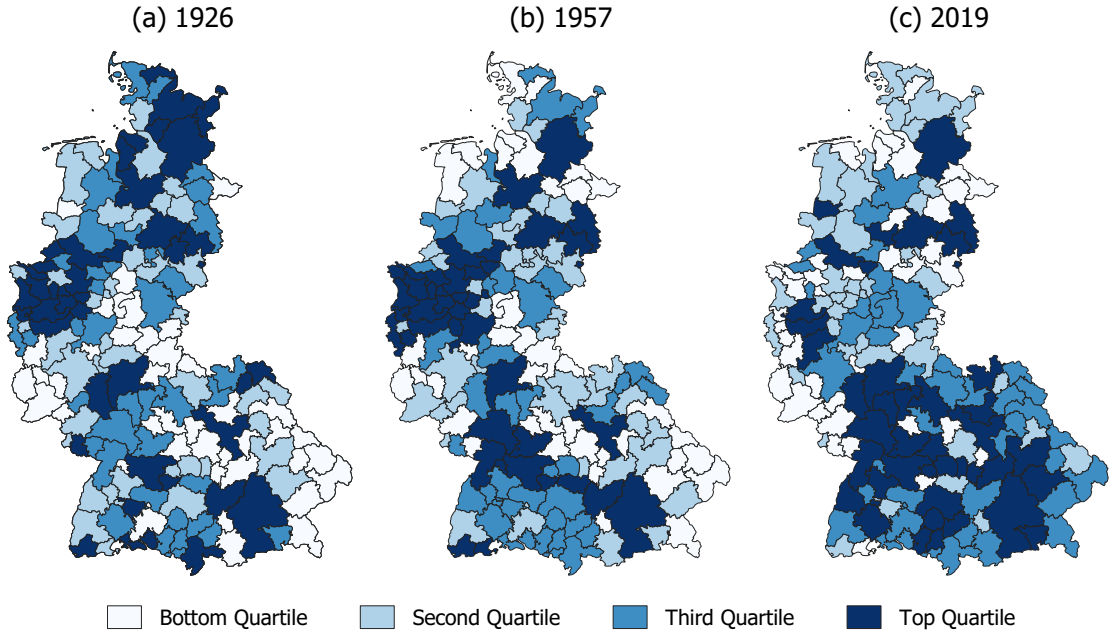
[8] Appendix Table 2.A1 shows that reversals are only slightly less frequent in 1957-2019 (when we have GDP per capita data also for the initial year).

TABLE 2.1: TRANSITIONS BETWEEN QUARTILES OF THE INCOME DISTRIBUTION, 1926-2019 (FREQUENCIES, ROW PERCENT)

		2019				
		Bottom	Second	Third	Top	∑
1926	Bottom	0.244	0.195	0.439	0.122	1.000
		(10)	(8)	(18)	(5)	(41)
	Second	0.342	0.244	0.220	0.195	1.000
		(14)	(10)	(9)	(8)	(41)
	Third	0.220	0.268	0.122	0.390	1.000
		(9)	(11)	(5)	(16)	(41)
	Top	0.200	0.300	0.225	0.275	1.000
		(8)	(12)	(9)	(11)	(40)
	∑	0.252	0.252	0.252	0.245	1.000
		(41)	(41)	(41)	(40)	(163)

Notes: The table compares positions in the income distribution of West German labor markets in 1926 and 2019. Entries are frequencies, expressed in row percentages. The count for each cell is in brackets. The ranking of labor markets in 1926 and 2019 is based on sales and GDP per capita data, respectively. Cells shaded in green (red) indicate labor markets rising from the bottom (top) to the top (bottom) half of the income distribution.

FIGURE 2.2: REGIONAL INCOME IN WEST GERMAN LABOR MARKETS, 1926-2019 (QUARTILE RANKS)



Notes: Each map shows the quartile rank in the income distribution of West German labor markets in 1926 (panel a), 1957 (panel b) and 2019 (panel c).

In 2019, the regional distribution of incomes has changed significantly. Labor markets in the Ruhr area in particular have slipped in the income ranking. The same applies to some of the historically rich regions in northern Germany, such as Bremerhaven or Itzehoe. By contrast, only a few of today's poorest labor markets are still to be found in the southeast. Instead, the poorest regions are now concentrated in the far west and northwest of West Germany. Several large centers of the automotive industry (Wolfsburg, Ingolstadt, Munich, Stuttgart and Sindelfingen) top the rankings, accompanied by large cities such as Frankfurt, Düsseldorf and Cologne.

The emerging North-South divide. Figure 2.2 illustrates that the economic weights within West Germany have shifted significantly over the period 1926-2019. The regions that lost ground in the income distribution were predominantly in the west and north, while the winning regions were predominately in the south of Germany (see Appendix Figure 2.A3 for a map illustrating the transitions between the top and bottom halves in 1926-2019). The North-South divide, subject of current policy debates (e.g., Schrader & Laaser, 2019), has thus emerged over the past 100 years or so.

We date the emergence of the divide, and quantify its extent, by estimating the following regression for different years:

$$\tilde{y}_{i,t} = \dot{\alpha} + \dot{\beta}_t N_i + \dot{\epsilon}_{i,t}, \tag{2.2}$$

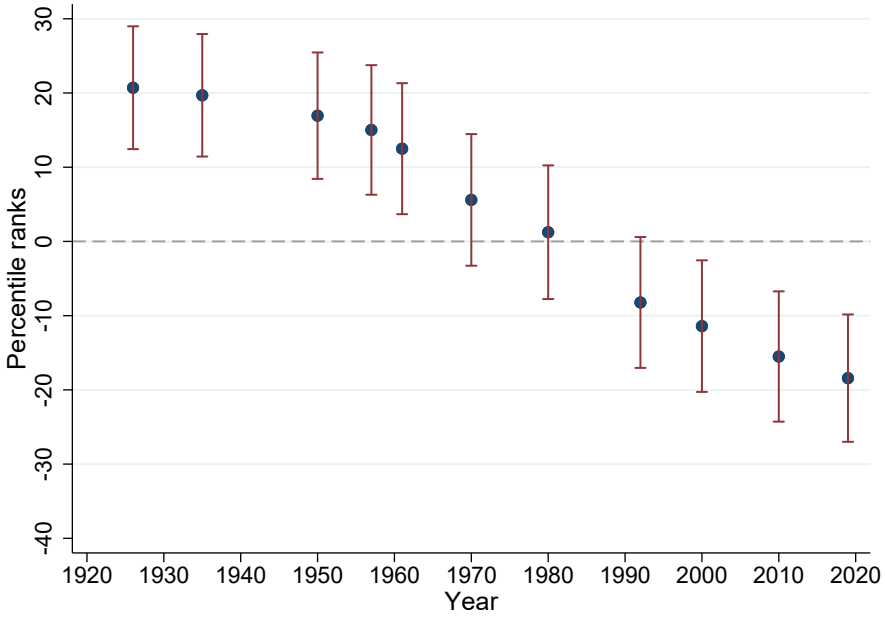
where $\tilde{y}_{i,t}$ is the percentile rank of labor market i in the income distribution of year t and N_i is a dummy for labor markets located in the North.[9] Parameter $\dot{\beta}_t$ then measures the average difference in percentile ranks between labor markets in North and South Germany at time t.

Figure 2.3 plots the estimates of the $\dot{\beta}_t$ coefficient from equation (2.2). In 1926, northern labor markets ranked, on average, 20.7 percentiles higher than southern ones in the income distribution. After World War II, the North's lead gradually diminished. By 1980, it had disappeared. The North-South gap becomes visible in 1992 and has widened since then. In 2019, northern labor markets rank, on average, 18.3 percentiles below southern ones. In western Germany, then, there has been a reversal of fortune between its northern and southern regions over the past century.

The reversal is also visible in the separate transition matrices for North and South Germany, reported in Table 2.A2 in the appendix. Positive reversals—with labor markets rising from below- to above-median per capita GDP—cluster in the South (34 out of 40 cases). In contrast, negative reversals are concentrated in the North (31 out of 40 cases).

[9] Our baseline definition of northern labor markets adheres to federal states borders. It classifies labor markets located in Bremen, Hamburg, Lower Saxony, North Rhine-Westphalia and Schleswig-Holstein as northern. Southern labor markets are those in Bavaria, Baden-Württemberg, Hesse, and Rhineland-Palatinate (see Appendix Figure 2.A2 for an illustration). Appendix Figure 2.A4 shows that the reversal of fortune does not hinge on this specific classification. It remains visible if we also assign the northern parts of Hesse and Rhineland-Palatinate to the North or if we use the latitude as a continuous measure to divide labor markets into northern and southern ones.

FIGURE 2.3: PERCENTILE RANK DIFFERENCES BETWEEN NORTH AND SOUTH GERMAN LABOR MARKETS, 1926-2019



Notes: The figure plots the $\hat{\beta}_t$ coefficients from OLS estimations of equation (2.2). Point estimates are marked by a dot. The vertical bands indicate the 95% confidence interval of each estimate.

Consequently, northern and southern labor markets drastically changed their overall position in the national income distribution. For example, the share of northern labor markets in the top income quartile fell from 65.0% in 1926 to just 27.5% in 2019. Conversely, the North's share in the lowest income quartile increased from only 14.6% to 61.0%.

The end of convergence. Underlying the marked shifts in the relative position of West German labor markets are regional differences in growth rates. Importantly, we observe β-convergence among West German labor markets only until 1992 but not thereafter. Let $y_{i,t}$ be GDP per capita of economy i at time t. Absolute convergence implies that in a regression of (annualized) growth between time t and time $t+s$ on initial GDP,

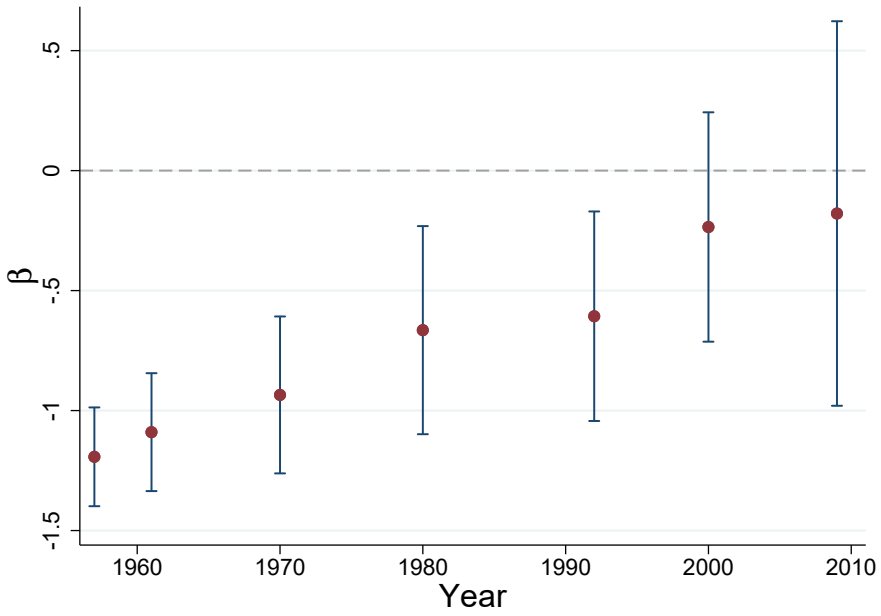
$$\frac{1}{s}\log\left(\frac{y_{i,t+s}}{y_{i,t}}\right) = \alpha + \beta\log\left(y_{i,t}\right) + \epsilon_{i,t+s}, \tag{2.3}$$

the parameter β is negative (see, e.g., Barro & Sala-i Martin, 1991).[10]

Figure 2.4 plots estimates of β from OLS regressions of equation (2.3). Annualized GDP per capita growth, the dependent variable, is calculated from the various start points shown on the x-axis to 2019. The start points include the first year of our GDP

[10] Tests of β-convergence are typically motivated by the neoclassical growth model. It predicts that poorer economies with smaller capital stocks grow faster due to diminishing returns. Given access to the same technology, poorer countries then catch up with richer ones as they accumulate capital faster. Another driver of convergence is technology transfers from leader to follower economies (e.g. Abramovitz, 1986).

FIGURE 2.4: β-CONVERGENCE FROM VARIOUS STARTING DATES TO 2019



Notes: The figure plots the β coefficients from OLS estimations of equation (2.3). Point estimates are marked by a dot. The vertical bands indicate the 95% confidence interval of each estimate. Each estimate comes from a separate regression. Regressions differ in the starting point for calculating annualized GDP growth. The starting points are 1957, 1961, 1970, 1980, 1992, 2000, 2009. The end point is always 2019.

data series (1957) and years closest to the end of each subsequent decade. The figure shows that there is β-convergence for start dates between 1957 and 1992 but not thereafter. Thus, poorer labor markets grew faster than richer ones only in the first half of our sample period (when the gap between the North and South narrowed). Appendix Figure 2.A5 reiterates this point: It shows the unconditional relationship between initial GDP and subsequent annual growth for two sub-periods, 1957-1992 and 1992-2019. A negative relationship is apparent for the earlier period but vanishes for the later one. None of these results are driven by outliers.

In fact, the dispersion of real per capita GDP levels in West Germany has widened since 1980. Table 2.2 documents how the standard deviation of log $(y_{i,t})$, σ_{y_t}, has changed over time. The standard deviation decreased markedly between 1957 and 1980, before increasing afterwards (without returning to its 1957 level).[11] We thus observe strong σ-convergence in 1957-1980, followed by moderate σ-divergence.[12] Table 2.2 also shows that other common measures of regional disparities (coefficient of variation, 90/10 ratio, Gini coeffficient) exhibit similar trends. All measures declined markedly between 1957 and 1980 but have increased since then. Similar trends in regional inequality have recently been documented also for other advanced economies (Floerkemeier et al., 2021;

[11] Comparisons of the dispersion over time might be complicated by the fact that the data come from different GDP revisions. However, we find similar patterns when we compare only the dispersion between years for which the data come from the same GDP revision.

[12] See Sala-i Martin (1996) and Young, Higgins & Levy (2008) for a discussion of the concept of σ-convergence and how it relates to β-convergence.

TABLE 2.2: REGIONAL DISPARITIES IN REAL GDP PER CAPITA, 1957-2019

	1957	1980	2000	2019
σ	0.235	0.162	0.180	0.191
Coefficient of variation	0.242	0.169	0.194	0.208
90/10 ratio	1.799	1.514	1.548	1.581
Gini coefficient	0.132	0.091	0.100	0.107

Notes: The table reports four measures of regional disparities in real GDP per capita. σ is the standard deviation of log real per capita GDP. The coefficient of variation is defined as the standard deviation in GDP per capita divided by its mean. The 90/10 ratio is the ratio of GDP per capita at the 90th to 10th percentile. The Gini coefficient gives equal weights to all regions, i.e., considers each region as an "individual". It ranges from zero (perfect equality) to one (maximal inequality).

Rosés & Wolf, 2021).

2.4 Early Industrialization and Economic Development

This section tests the hypothesis that early industrialization was first conducive and later detrimental for economic development, and examines possible channels through which early industrialization might still influence development today.

The effect of industrialization on development, 1926-2019. We estimate the effect of early industrialization on subsequent development using 2SLS. The second stage regression quantifies the effect of the standardized industrial employment share in 1882, $I_{i,1882}$, on a labor market's percentile rank in the income per capita distribution:

$$\tilde{y}_{i,t} = \ddot{\alpha} + \ddot{\beta}_t \hat{I}_{i,1882} + \mathbf{X}_i^{'} \ddot{\gamma}_t + \ddot{\epsilon}_{i,t}, \tag{2.4}$$

where $\mathbf{X}_i$ is a set of control variables. The first stage regression uses the (log) weighted least-cost distance to European coalfields, C_i, as an instrument for early industrialization (see Section 2.2 for details on the construction of the instrument):

$$I_{i,1882} = \delta + \zeta \log(C_i) + \mathbf{X}_i^{'} \eta_t + u_i, \tag{2.5}$$

where $\mathbf{X}_i$ contains the same control variables as in equation (2.4).

The key identifying assumption for the 2SLS regression to yield a consistent estimate of our coefficient of interest, $\ddot{\beta}$, is $Cov(C_i, \ddot{\epsilon}_{i,t}) = 0$. The assumption states that (i) there is no unobserved factor that drives economic development and is correlated with C_i and that (ii) C_i affects economic development only through its effect on early industrialization. To rule out that our instrument merely captures favorable location and thus better market access in general, we include the weighted least-cost distance to all European

TABLE 2.3: EARLY INDUSTRIALIZATION AND REGIONAL ECONOMIC DEVELOPMENT

	1926		1957		2019	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)
Employment share industry 1882	14.42***	13.19***	18.38***	16.75***	-2.14	-14.33***
	(2.14)	(3.80)	(1.96)	(3.12)	(1.86)	(5.07)
Observations	163	163	163	163	163	163
R-squared	0.217		0.399		0.139	
F-statistic, 1st stage		23.58		23.58		23.58

Notes: The table shows results from OLS (columns 1, 3, and 5) and 2SLS (columns 2, 4, and 6) regressions of the effect of early industrialization on regional economic development. The ranking in 1926 is based on sales per capita, the rankings in 1957 and 2019 are based on GDP per capita. The 1882 employment share in industry, our explanatory variable of interest, is standardized with a mean of zero and a standard deviation of one. The instrument used in the 2SLS regressions is the log weighted average distance to European coalfields where coalfield sizes serve as weights (see Section 2.2). All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

land cells as control variable. Intuitively, the control measures a region's geographic isolation within Europe.[13] We thus exploit only the residual variation in coal access, which is not driven by a region's favorable location in general. Furthermore, we control for the number of towns per square kilometer in 1700, reported in Cantoni, Mohr & Weigand (2020), to capture differences in pre-industrial development.

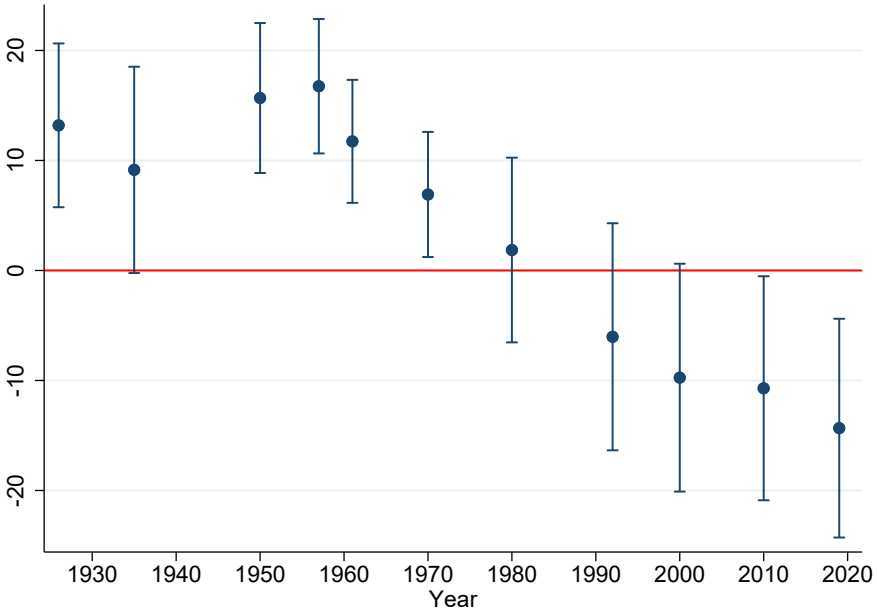
Table 2.3 reports OLS and 2SLS regression estimates of the effect of early industrialization on economic development for 1926, 1957, and 2019. These years include the start and end point of our sample period as well as the first year for which we have GDP per capita data. The OLS estimate in column (1) implies that an increase in the 1882 industrial employment share by one standard deviation improves the rank in the 1926 income distribution by 14.42 percentiles. The 2SLS estimate in column (2) is only slightly smaller than the OLS estimate. Early industrialization was thus still conducive to economic development in 1926. The same holds for 1957 (see columns (3) and (4)), just before the coal crisis began with a collapse in demand in the winter of 1957/58.

In 2019, in contrast, early industrialization has an adverse effect on a labor market's ranking in the income distribution. While the OLS estimate in column (5) is relatively small, the 2SLS estimate is sizable (column (6)). The latter implies that an increase in the 1882 industrial employment share by one standard deviation decreases a labor market's rank in the income distribution by 14.33 percentiles. The difference between OLS and 2SLS estimates suggests that early industrialization correlates with local characteristics that still foster economic development today.[14] The first stage F-Statistic of 23.58 suggests

[13] Ashraf, Galor & Ömer Özak (2010) establish that, in contrast to conventional wisdom, prehistoric geographical isolation has positive long-run effects on cross-country differences in economic development.

[14] Esposito & Abramson (2021) also find that the adverse effects of historical coal mines on contemporary income are 2-3 times larger (in absolute magnitude) in their IV regressions compared to the OLS estimates. Franck & Galor (2021) show that the early adoption of steam had negative effects on GDP per capita of

FIGURE 2.5: THE EFFECT OF EARLY INDUSTRIALIZATION ON THE PERCENTILE RANK IN THE INCOME DISTRIBUTION



Notes: The figure plots the $\ddot{\beta}_t$ coefficients from 2SLS estimations of equation (2.4). Point estimates are marked by a dot. The vertical bands indicate the 95% confidence interval of each estimate. The dependent variable is the percentile rank in the income per capita distribution. The 1882 employment share in industry, our explanatory variable of interest, is standardized with a mean of zero and a standard deviation of one.

that we do not have a weak instrument problem (see Stock & Yogo, 2005, for critical values).

Overall, our analysis shows that early industrialization had a long-lasting positive effect on economic development, which, however, eventually turned negative. Figure 2.5 plots coefficient estimates of $\ddot{\beta}_t$ from equation (2.4) for the years 1926, 1935, 1950, 1957, 1961, 1970, 1980, 1992, 2000, 2010, and 2019. The positive effect of early industrialization is persistent in 1926-1957. If anything, the effect increases from 1935 to 1957, perhaps reflecting the elevated importance of heavy industries for both Germany's war economy and the country's reconstruction efforts after the war.[15] The positive effect of 19th-century industrialization begins to shrink in 1957, in parallel with the onset of the coal crisis. The point estimate turns negative in 1992 and has been declining ever since.

Robustness checks. We conduct several tests, reported in Appendix Table 2.A3, to assess the robustness of our results. First, we add a rich set of controls for local geographic

French departments in 2001-2005. Importantly, their IV estimate reverses the OLS estimates from a positive to a negative one'.

[15] The coefficient estimate of $\ddot{\beta}_t$ increases from 9.15 in 1935 to 15.68 in 1950 and 16.75 in 1957. This increase can not reflect the change in the variable used for constructing percentile ranks, as we use sales per capita for both 1935 and 1950.

and climatic conditions to our baseline specification. Second, we exclude the Ruhr region and Germany's Free Hanseatic cities from our sample. Third, we construct the instrument using alternative cost vectors for the least-cost paths to the coalfields. Fourth, we estimate population- and area-weighted regressions. Fifth, we use log GDP per capita as our dependent variable and only consider the 1882 employment share in core industrial occupations as main explanatory variable. Our key result proves robust in all of these checks: Early industrialization has a beneficial effect on economic development in the medium term, but a detrimental effect in the long term.

Using levels of GDP per capita as dependent variable (rather than ranks) also sheds additional light on the effect size. According to the estimates, a one standard deviation increase in the 1882 industrial employment share increased GDP per capita in 1926 and 1957 by 0.19 and 0.15 log points, respectively. However, it decreases current GDP per capita by 0.09 log points.

Channels. Previous work on the long-term effects of industrialization point to the detrimental effects on human capital as the main channel (Franck & Galor, 2021). Indeed, Esposito & Abramson (2021) find that former coal mining regions in Europe invested less in tertiary education. In the German context, however, it is unlikely that a lack of investment in higher education explains the adverse long-term effects of early industrialization. In the Ruhr region, for example, universities were opened in Bochum (1965), Dortmund (1968), Duisburg (1972), and Essen (1972). Appendix Table 2.A4 confirms that early industrialized regions do not have a lower share of people with a university degree today. Rather, early industrialization is positively associated with higher education (although the effect is small and not statistically significant).[16]

Why does early industrialization hinder regional economic development in Germany today if it does not impair tertiary education? Economic historians have hypothesized that the high adjustment pressure faced by Germany's early industrial regions after 1957 exceeded their limited capacity for adjustment and innovation (e.g. Grabher, 1993; Hamm & Wienert, 1990; Junkernheinrich, 1989). The resulting deindustrialization and the persistent weakness of innovation are hampering economic development today.

That the old industrial regions were exposed to high adjustment pressure after 1957 is undisputed. Table 2.4 shows that in 1950, just before the outbreak of the coal crisis, the positive effect of early industrialization on industrial employment was almost entirely due to the coal, iron, and steel industries. A one standard deviation increase in early industrialization increased the industry employment share by 9.6 percentage points in 1950 (column 1), of which 8.3 percentage points were attributable to the coal, iron, and steel industries (column 2). It was precisely these industries that fell into crisis in the 1960s and 1970s. By 1950, early industrialization had already a negative effect on employment in

[16] We use data on individuals with a university degree from the 1970, 1987, and 2011 censuses. Earlier censuses did not ask about the educational attainment. For none of the three years considered do the 2SLS regressions show a statistically significant effect of early industrialization on the share of individuals with a university degree. The estimated coefficient changes from negative to positive between 1970 and 2011, consistent with the establishment of new universities in former industrial regions after World War II.

TABLE 2.4: EARLY INDUSTRIALIZATION AND INDUSTRY EMPLOYMENT, 1950 & 2019

	Industrial employment share (%)			
	1950			2019
	Total	Coal, iron and steel	Modern industries	Total
	(1)	(2)	(3)	(4)
Employment share industry 1882	9.63***	8.34***	-0.97*	-6.25***
	(1.52)	(1.83)	(0.52)	(1.24)

Notes: The table shows results from 2SLS regressions of the effect of early industrialization on employments shares in industry. The dependent variable is the total industrial employment shares in 1950 (column 1) and 2019 (column 4), and the 1950 shares in coal, iron, and steel (column 2) and "modern industries" (column 3). The latter encompass mechanical engineering, road vehicle and aircraft construction, electrical engineering, precision mechanics, optics, the chemical industry and plastics. The 1882 employment share in industry is standardized with a mean of zero and a standard deviation of one. All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

"modern industries" (column 3), such as mechanical engineering, electrical engineering, the automobile industry, and the chemical industry. These modern industries continued to flourish after 1945 and are still associated with Germany's economic strength today.

Column (4) of Table 2.4 shows that Germany's former industrial heartland has failed to revitalize its industrial base in new growth sectors and suffered from deindustrialisation. We find that a one standard deviation increase in early industrialization decreases the employment share in industry by 6.3 percentage points in 2019.[17] Deindustrialization in historically industrial regions hinders local innovation, as patent applications are mainly filed in the industrial sector (Kiese, 2019). Low levels of innovation, in turn, are likely to slow regional economic growth (e.g. Akcigit, Grigsby & Nicholas, 2017b). Today, value-added per employee is almost 20% higher in industry than for the German economy as a whole. Deindustrialization and low innovation are thus plausible channels through which early industrialization hinders long-term prosperity.

We employ the causal mediation framework for linear IV models developed by Pinto, Dippel, Gold & Heblich (2020)[18] to show that the adverse effect of early industrialization is indeed mediated through deindustrialization and the ensuing lack of innovation. Results are in Table 2.5. Panel (A) uses patents per capita as mediator variable. Column (1) reproduces our baseline 2SLS results of the effect of early industrialization on per capita

[17] Appendix Figure 2.A6 shows that early industrialization has a positive effect on industrial employment only until 1970. The effect then becomes increasingly negative, in line with previous findings for France (Franck & Galor, 2021). The figure also illustrates that the negative effect on industrialization goes hand in hand with positive effects on service employment. In contrast, in the 1950s and 1960s, early industrializing regions had higher employment shares in both industry and services.

[18] The approach allows us to estimate the proportion of the total treatment effect in linear IV settings that can be explained by a mediator variable without requiring an additional instrument for the mediator. Identification is possible under the so-called partial confounding assumption. This assumption states that confounding variables that jointly cause the treatment and the mediator are independent of the confounding variables that jointly cause the mediator and the outcome. See Dippel, Ferrara & Heblich (2020) for details on the implementation and Dippel, Gold, Heblich & Pinto (2021) for an application.

income ranks in 2019. The total effect is -14.33 percentiles. Column (2) shows that early industrialization indeed decreases innovative activity. A one standard-deviation increase in early industrialization reduces patents per capita in 2003-2012 by 0.355 log points.[19] Column (3), in turn, suggests that patenting has a positive effect on a labor market's rank in the income distribution (of 30.769 percentiles per log point increase in patents). Therefore, lower innovation activity explains -10.92 ($= -0.355 \times 30.70$) percentiles–or 76%–of the total effect of early industrialization on economic development. Panel (B) directly uses industry employment in 2019 as mediator. The analysis suggests that all of the negative long-run effects of early industrialization operates through deindustrialization.[20]

TABLE 2.5: 2SLS MEDIATION ANALYSIS

	Panel (A): Patents per capita 2003-2012		
	$I_{1882} \rightarrow \tilde{y}_{2019}$	$I_{1882} \rightarrow p_{2012}$	$p_{2012} \rightarrow \tilde{y}_{2019}$
	(1)	(2)	(3)
Employment share industry 1882 (I_{1882})	-14.33***	-0.355***	-3.41*
	(5.07)	(0.101)	(2.02)
Log patents p.c. 2003-2012 (p_{2012})			30.70***
			(8.72)
	Direct effect: -3.41* (2.02)		
	Indirect effect: -10.92** (4.39)		
	Panel (B): Industrial employment share 2019		
	$I_{1882} \rightarrow \tilde{y}_{2019}$	$I_{1882} \rightarrow I_{2019}$	$I_{2019} \rightarrow \tilde{y}_{2019}$
	(1)	(2)	(3)
Employment share industry 1882 (I_{1882})	-14.33***	-0.063***	2.42
	(5.07)	(0.012)	(2.55)
Employment share industry 2019 (I_{2019})			267.88***
			(84.74)
	Direct effect: 2.42 (2.55)		
	Indirect effect: -16.75*** (6.25)		

Notes: The table presents second stage results of the causal mediation framework for linear IV models introduced in Pinto et al. (2020). The outcome variable is the GDP per capita rank in 2019. The mediator variable is average patents per 1000 inhabitants in 2003-2012 (in logs) and the industrial employment share in 2019 (in %) in Panel (A) and (B), respectively. Column (1) reproduces, from column (6) of Table (2.3), 2SLS regression results of the effect of early industrialization on the outcome. Column (2) shows 2SLS results of the effect of early industrialization on the mediator variable, and column (3) of the effect of the mediator variable on the outcome (controlling for early industrialization). The indirect effect is the product of the coefficients on early industrialization in column (2) and on the mediator variable in column (3). The instrument is the weighted average distance to European coalfields where coalfield sizes serve as weights (see Section 2.2). All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Why have early industrialized regions been unable to maintain, let alone expand, their position in high-growth industries? Possible answers to this question are complex, but usually begin with the lopsided economic structure of early industrialized regions.

[19] Data on patent applications to the European Patent Office by NUTS-3 regions come from Eurostat. We average patent applications from the last ten years available.

[20] Unreported regression results also suggest that the adverse effects of early industrialization on current innovation activity indeed operates through deindustrialization.

Most old industrial regions were historically characterized by monostructural agglomerations, typically in heavy and extractive industries (Hu & Hassink, 2016). Large corporations and close interregional business linkages dominated local economies. These tightly knit industrial networks created a "cognitive lock-in" that prevented the regional economy from adapting (Grabher, 1993). Large corporations created a tradition of dependent employment and a corresponding lack of entrepreneurial role models (Stuetzer, Obschonka, Audretsch, Wyrwich, Rentfrow, Coombes, Shaw-Taylor & Satchell, 2016).[21] Corporations were also closely linked to local governments and unions that supported the old mining industrial structures. Large subsidies to the coal, iron, and steel complex maintained outdated structures in Germany's industrial heartland (Hamm & Wienert, 1990; Hassink & Kiese, 2021). In addition, the early industrial regions were not attractive to companies willing to locate there because heavy industry paid relatively high wages (Junkernheinrich, 1989).

Although a rigorous test is beyond the scope of this paper, we provide evidence consistent with these arguments in Appendix Table 2.A5. At the beginning of the coal and later the steel crisis, early industrialized regions were indeed characterized by corporate giants, high employment shares in large firms, and high sectoral concentration of employment in industry. Moreover, self-employment rates were low and industrial wages were high when the crisis hit.[22]

As suspected, early industrialization also led to a rigid policy environment. Little political change took place. We find that in the old industrial regions it was less likely that the mayoralty was held by a party other than the dominant one. Of the major parties, the social democratic SPD benefited most from early industrialization, both in local and federal elections. The SPD has traditionally represented the interests of the working class, especially unionized workers. Maintaining the heavily unionized coal and steel sector was in the interest of politicians and unions struggling to defend their political base. Overall, adherence to the existing economic structure was therefore the consensual denominator of local action by companies, politicians, and unions (Grabher, 1993; Junkernheinrich, 1989).

2.5 Early Industrialization, Reversal of Fortune(s), and Changing Inequality

To what extent can the blessings and curses of early industrialization explain the changing fortunes of West German labor markets, documented in Section 2.3? This section considers the role of industrialization for two key empirical patterns: the emerging North-South divide and the fall and rise of regional inequality.

[21] Equal division inheritance rules, in addition to the lack of coal, favored the emergence of a 'decentralized industrial order' in South-West Germany, dominated by small and medium-sized enterprises (Bartels, Jäger & Obergruber, 2020; Herrigel, 1996).

[22] We measure outcomes in 1957 (when the coal crisis began) or just before the crisis began. The local employment share in large firms is available only for 1970.

TABLE 2.6: MEAN DIFFERENCES IN INCOME RANKS BETWEEN NORTHERN AND SOUTHERN LABOR MARKETS (IN PERCENTILES)

	1926 (1)	1957 (2)	2019 (3)
Actual mean difference	20.71	15.02	-18.42
	(4.22)	(4.45)	(4.38)
Predicted mean difference	8.29	10.47	-8.96
	(2.15)	(2.71)	(2.32)

Notes: The table reports actual and predicted mean differences in income ranks between northern and southern labor markets in 1926 (column 1), 1957 (column 2), and 2019 (column 3). The actual and predicted mean differences are the slope coefficients from a regression of actual and predicted income rank, respectively, on an indicator variable for northern labor markets (see equation (2.2) for the regression using actual income ranks). We calculate the predicted income rank as $\hat{\ddot{\beta}}_t I_{i,1882}$. Robust standard errors are in parentheses.

Germany's reversal of fortune(s). Consider first the North-South divide. Table 2.6 compares the actual divide with the predicted divide resulting from our 2SLS estimates. The latter is the average difference in percentile ranks between northern and southern regions that would have resulted if the regions had differed only in their 1882 industrial employment share.[23] As shown, the actual mean difference evolves from $+20.71$ percentiles in 1926 to -18.42 percentiles in 2019. The mean difference in predicted income ranks follows a similar, though less pronounced, trajectory.

Our estimates imply that in 1926, per capita income would have been 8.29 percentile ranks higher in the North than in the South if the regions had differed only in the 1882 employment share in industrial occupations. This northern advantage in predicted income ranks is due to the fact that the average industrial employment share in 1882 was considerably larger in the North than in the South (0.223 versus 0.156) and that early industrialization had a positive effect on economic development in 1926. By 2019, the average differences in predicted income have become negative at -8.96 percentile ranks, reflecting the adverse effect of early industrialization on current development.

A "back-of-the-envelope" calculation suggests that early industrialization explains 48.6% (=8.96/18.42) of the current North-South gap. Therefore, the boon and bane of early industrialization contributed significantly to the North-South reversal. Today, the North has a much smaller industrial base than the South after decades of industrial leadership (see Figure 2.A7 for trends in industrial employment shares over the period 1882-2019). Appendix Table 2.A6 shows that early industrialization also predicts which individual labor markets experienced a reversal in the 1926-2019 period.[24]

[23] We first use the 2SLS estimate of $\ddot{\beta}_t$ in equation (2.4) to predict each labor market's income rank, given its 1882 industrial employment share. We then estimate the slope coefficient $\tilde{\beta}_t$ from a regression of the *predicted* income rank on N_i. The estimate yields the mean difference in predicted GDP per capita rank between northern and southern labor markets.

[24] The table presents 2SLS estimates from regressing dummy variables identifying negative and positive reversals on the industrial employment share in 1882 and our standard control variables. The estimate in column (1) implies that a one standard deviation increase in the 1882 industrial employment share increases the probability of moving from the top to the bottom half of the income distribution by 14.6 percentage points

Regional inequality. Consider next the decline and rise of regional inequality. How much of the overall change in inequality can be attributed to regional differences in early industrialization and their differential effect on economic development over time? To answer this question, we decompose the total change in inequality into an "industrialization effect" and a residual. We calculate the industrialization effect as the difference between observed changes in inequality and the counterfactual change in inequality that would have occurred in the absence of differences in early industrialization. The industrialization effect thus measures the contribution of differences in early industrialization to the change in regional inequality.

Let y^c_{it} denote the counterfactual log income per capita of a labor market i in year t, i.e., the income that would result if the 1882 share of industrial employment had been equal to the mean in all labor markets.[25] For the period $t-1$ to t, the contribution of the industrialization effect to the overall change in σ_{y_t}, the standard deviation of log income per capita, is given by:

$$\begin{aligned} \Delta IND_{t,t-1} &= \overbrace{\left[\sigma_{y_t} - \sigma_{y_{t-1}}\right]}^{\text{Actual change}} - \overbrace{\left[\sigma_{y^c_t} - \sigma_{y^c_{t-1}}\right]}^{\text{Counterfactual change}} \\ &= \underbrace{\left[\sigma_{y_t} - \sigma_{y^c_t}\right]}_{\text{Effect on } \sigma \text{ in } t} - \underbrace{\left[\sigma_{y_{t-1}} - \sigma_{y^c_{t-1}}\right]}_{\text{Effect on } \sigma \text{ in } t-1}. \end{aligned} \tag{2.6}$$

The second line of equation (2.6) shows that $\Delta IND_{t,t-1}$ also reflects the difference in the within-year effect of early industrialization on inequality.

Table 2.7 reports σ_{y_t} and $\sigma_{y^c_t}$ for 1957, 1980, and 2019 and the changes in 1957-1980, 1980-2019, and 1957-2019. The first key observation is that the waning effect of early industrialization explains much of the decline in σ between 1957 and 1980. In 1957, regional differences in early industrialization increased the dispersion of real per capita income by 0.054 log points (the difference between $\sigma_{y_{1957}}$ and $\sigma_{y^c_{1957}}$ reported in the last row). By 1980, however, this effect had declined to just 0.004 points,[26] since early industrialization had no longer a sizeable effect on economic disparity in that year (see Figure 2.5). Overall, the industrialization effect explains -0.050 (=$0.004 - 0.054$) log points—or about 69%—of the actual change in σ of -0.073 over the 1957-1980 period.

over the 1926-2019 period (from a mean probability of 24.5%). The estimate increases to 22.2 percentage points if we consider reversals in 1957-2019 in column (2). Conversely, columns (3) and (4) show that early industrialization markedly decreased the probability of moving up from the bottom to the top half of the income distribution in 1926-2019 and 1957-2019, respectively. The predictive power comes from the fact that early industrialization affects both the initial position in 1926 and the final position in 2019. In unreported regressions, we find that early industrialization still predicts reversals if we restrict the sample to labor markets "at risk" of a reversal (i.e., those in the upper (lower) half of the initial distribution for negative (positive) reversals).

[25] The standardized industrial employment share, $I_{i,1882}$, is then zero. We calculate the counterfactual log income per capita as $y^c_{it} = y_{it} - \hat{\beta}_t I_{i,1882}$ where $\hat{\beta}_t$ is the 2SLS estimate from the regression model (2.4) (with log income per capita as dependent variable).

[26] Earlier work for Germany documented that industrialization increased inequality in the late 19th century (see, e.g., Frank, 1993; Gutberlet, 2014; Braun & Franke, 2022). Together with our results, these findings are consistent with the argument that regional disparities first increase, then stabilize, and finally decline as industrialization progresses (Kuznets, 1955).

TABLE 2.7: COMPONENTS OF CHANGES IN REGIONAL PER CAPITA INCOME, 1957-2019

	1957 (1)	1980 (2)	2019 (3)	1957-1980 (2)-(1)	1980-2019 (3)-(2)	1957-2019 (3)-(1)
σ_{y_t}	0.235	0.162	0.191	-0.073	0.030	-0.043
$\sigma_{y_t^c}$	0.180	0.158	0.205	-0.023	0.047	0.024
Δ	0.054	0.004	-0.013	-0.050	-0.017	-0.068

Notes: The table reports σ_{y_t} and $\sigma_{y_t^c}$, the standard deviation of actual and counterfactual log per capita income, for 1957 (column 1), 1980 (column 2), and 2019 (column 3). The last row reports $\sigma_{y_t} - \sigma_{y_t^c}$, i.e., the effect of early industrialization on real per capita dispersion in year t. The last three columns report changes between 1957-1980, 1980-2019, and 1957-2019, respectively. Cells shaded in gray report the industrialization effect, $\Delta IND_{t,t-1}$, as defined in equation (2.6).

The second key result from Table 2.7 is that the industrialization effect cannot explain the increase in regional inequality since 1980. The changes in σ_{y_t} and $\sigma_{y_t^c}$ move largely in parallel over the 1980-2019 period. Therefore, the increase in regional inequality would have occurred even if regions had not differed in their industrialization paths. If anything, regional differences in early industrialization dampened the increase by reducing current inequality. We find that differences in early industrialization reduced the dispersion of real per capita income by 0.013 log points in 2019. Because labor markets with higher counterfactual income per capita tend to have a higher 1882 industrial employment share, a moderately negative effect of early industrialization on economic development compresses the regional income distribution in our specific context.

An alternative decomposition isolates the change in inequality that is due to changes in $\ddot{\beta}_t$, the effect of early industrialization on income. Appendix Table 2.A7 shows that this decomposition[27] delivers even more pronounced results. The waning effect of industrialization—as captured by the decline in $\ddot{\beta}_t$—explains *all* of the decline in regional inequality between 1957 and 1980. What is more, the increasingly detrimental effect of early industrialization between 1980 and 2019 slightly reduced regional inequality over this period. These results imply that without changes in $\ddot{\beta}_t$, regional inequality in West Germany would have increased substantially between 1957 and 2019.

2.6 Conclusion

In recent decades, the spatial distribution of economic activity has changed fundamentally in many advanced countries. Germany is no exception in this respect. Economic

[27] The decomposition is $\overbrace{[\sigma_{y_t} - \sigma_{y_{t-1}}]}^{\text{Actual change}} = \overbrace{[\sigma_{y_t} - \sigma_{y^*}]}^{\text{Coefficient effect}} + \overbrace{[\sigma_{y^*} - \sigma_{y_{t-1}}]}^{\text{Remainder}}$ where $y^* = y_t - (\ddot{\beta}_t - \ddot{\beta}_{t-1})I_{i,1882}$. To obtain y^*, we thus replace the coefficient $\ddot{\beta}_t$ in equation (2.4) by $\ddot{\beta}_{t-1}$, while holding the effect of other observables and the distribution of residuals fixed. The decomposition is similar in spirit to that proposed by Juhn, Murphy & Pierce (1993). In our context, however, observable characteristics, including $I_{i,1882}$, do not vary over time. See Fortin, Lemieux & Firpo (2011) for an overview of the scope and limitations of different methods for decomposing distributional statistics.

power within the country shifted from the North to the South after World War II. While regional per capita incomes converged strongly in the 1960s and 1970s, regional inequality in West Germany has increased again in recent decades. This paper has shown that these far-reaching changes in the economic geography of West Germany cannot be understood without accounting for the long-lasting legacy of regional differences in 19th-century industrialization.

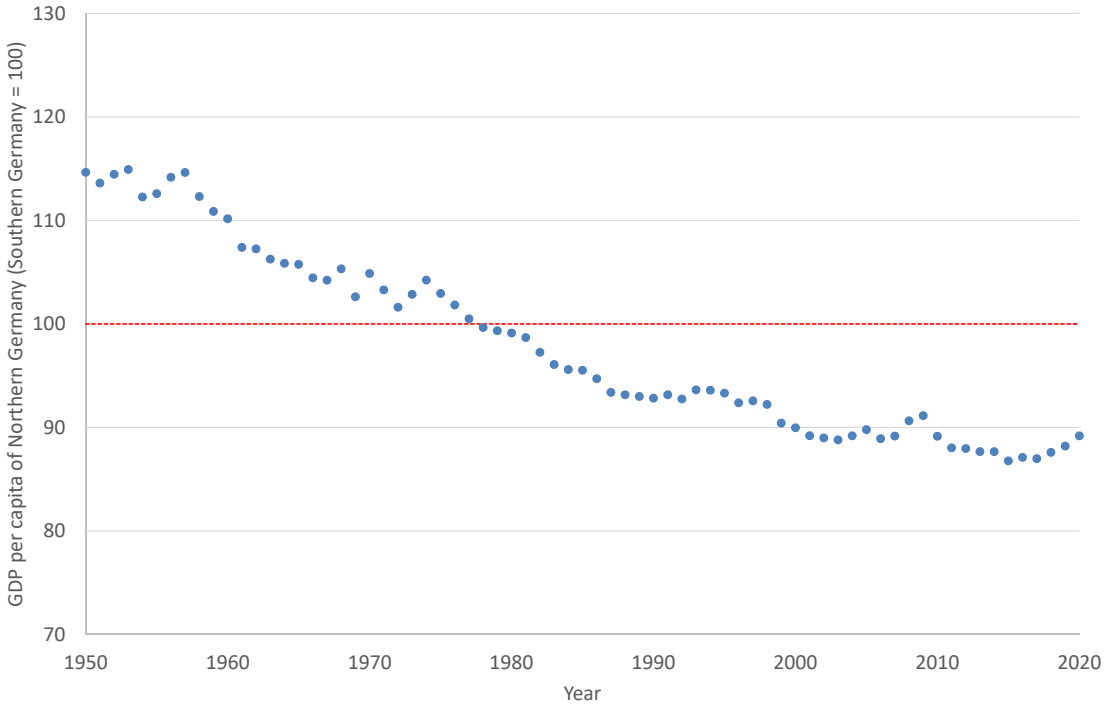
We show that early industrialization, measured by industrial employment in 1882, still strongly favored regional economic development in 1957. However, the positive effect diminished between 1957 and 1980, and industrialization became a drag on economic development at the turn of the 21st century. For identification, we exploit variation in access to coal deposits in Europe, while controlling for the connectedness to European markets. Whereas a one standard deviation increase in early industrialization improved a labor market's rank in the West German income distribution by 16.8 percentiles in 1957, it decreases the 2019 rank by 14.3 percentiles.

The initial blessing and later curse of early industrialization strongly influenced trends in regional inequality. We show that the waning advantage of early-industrializing regions markedly reduced regional inequality between 1957 and 1980. Moreover, the gap between North and South Germany, which emerged in the last forty years or so, cannot be understood without recourse to the regions' path to industrialization 140 years ago. Our estimates suggest that differences in early industrialization can explain about half of the current gap between North and South.

Our results have important implications for the policy discourse on regional inequality and economic decline. First, they illustrate that the interpretation of contemporary changes in regional inequality, which have received much attention recently (Iammarino et al., 2018; Floerkemeier et al., 2021), require careful consideration of the past. Development processes not only have lasting effects, but can also bring about future changes. Second, our results show that initial gains from industrialization can come at the expense of long-run losses (see also Matheis, 2016; Franck & Galor, 2021). This inter-temporal trade-off raises the question of whether policy interventions can prevent adverse effects in the long term. Indeed, Germany has managed to avoid the shortage of university graduates in early industrialized regions observed elsewhere in Europe (Esposito & Abramson, 2021), presumably by establishing new universities in its former industrial heartland. Third, our results tentatively suggest that the lopsided economic structure may have favored the negative long-term effects. A more diversified economic structure—as in the Italian industrial triangle of Piedmont, Lombardy and Liguria (Fenoaltea, 2003)—could therefore avoid the adverse long-term effects of industrialization in the first place. After all, Italy's old industrial triangle still generates above-average GDP per capita (e.g. Felice, 2018), in stark contrast to Germany's old industrial heartland.

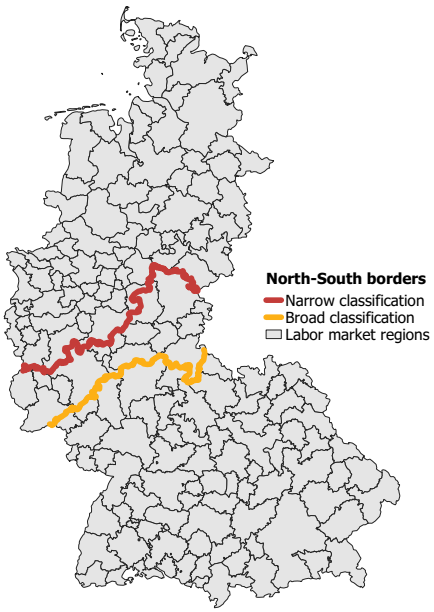
2.A Appendix

FIGURE 2.A1: NORMALIZED GDP PER CAPITA OF NORTH GERMANY, 1950-2020 (SOUTH GERMANY = 100)



Notes: The figure depicts the GDP per capita of North Germany relative to that of South Germany. North Germany includes the federal states of Bremen, Hamburg, Lower Saxony, North-Rhine Westphalia, and Schleswig-Holstein. South Germany includes the federal states of Baden-Württemberg, Bavaria, Hesse, and Rhineland-Palatinate.*Source*: Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder"

FIGURE 2.A2: DEFINITIONS OF NORTH AND SOUTH GERMANY



Notes: The narrower baseline definition adheres to federal states borders. It classifies labor markets located in Bremen, Hamburg, Lower Saxony, North Rhine-Westphalia, and Schleswig-Holstein as northern. Southern labor markets are those in Bavaria, Baden-Württemberg, Hesse, and Rhineland-Palatinate. The second, broader classification also assigns the northern parts of Hesse and Rhineland-Palatinate to the north.

TABLE 2.A1: TRANSITIONS BETWEEN QUARTILES OF THE INCOME DISTRIBUTION, 1957-2019 (FREQUENCIES, ROW PERCENT)

		2019				
		Bottom	Second	Third	Top	∑
1957	Bottom	0.417	0.220	0.293	0.073	1.000
		(17)	(9)	(12)	(3)	(41)
	Second	0.317	0.220	0.268	0.195	1.000
		(13)	(9)	(11)	(8)	(41)
	Third	0.049	0.317	0.293	0.342	1.000
		(2)	(13)	(12)	(14)	(41)
	Top	0.225	0.250	0.150	0.375	1.000
		(9)	(10)	(6)	(15)	(40)
	∑	0.252	0.252	0.252	0.245	1.000
		(41)	(41)	(41)	(40)	(163)

Notes: The table compares positions in the income distribution of West German labor markets in 1957 and 2019. Entries are frequencies, expressed in row percentages. The count for each cell is in brackets. The rankings of labor markets are based on GDP per capita data. Cells shaded in green (red) indicate labor markets rising from the bottom (top) to the top (bottom) half of the income distribution.

TABLE 2.A2: TRANSITIONS BETWEEN QUARTILES OF THE INCOME DISTRIBUTION, 1926-2019, BY REGION

(A) NORTH

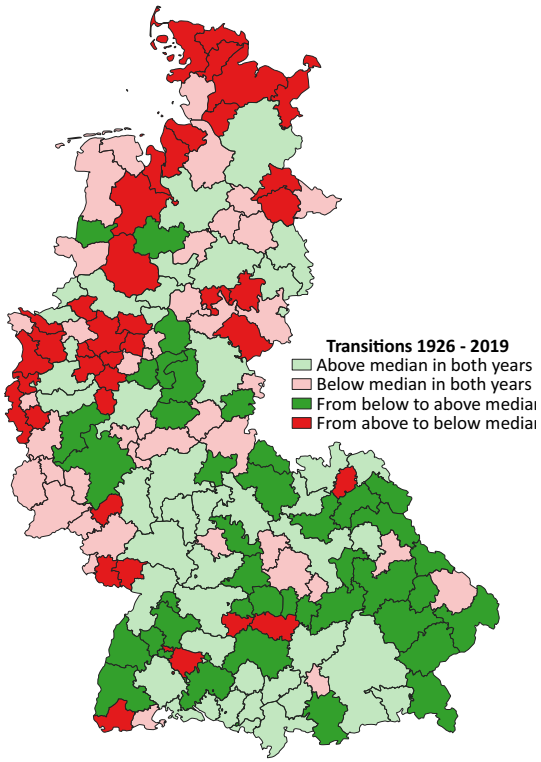
		2019				
		Bottom	Second	Third	Top	$\sum$
1926	Bottom	0.028	0.000	0.042	0.014	0.085
		(2)	(0)	(3)	(1)	(6)
	Second	0.140	0.099	0.014	0.014	0.268
		(10)	(7)	(1)	(1)	(19)
	Third	0.099	0.127	0.014	0.042	0.282
		(7)	(9)	(1)	(3)	(20)
	Top	0.085	0.127	0.070	0.085	0.366
		(6)	(9)	(5)	(6)	(26)
	$\sum$	0.352	0.352	0.140	0.155	1.000
		(25)	(25)	(10)	(11)	(71)

(B) SOUTH

		2019				
		Bottom	Second	Third	Top	$\sum$
1926	Bottom	0.087	0.087	0.163	0.044	0.380
		(8)	(8)	(15)	(4)	(35)
	Second	0.044	0.033	0.087	0.076	0.239
		(4)	(3)	(8)	(7)	(22)
	Third	0.022	0.022	0.044	0.141	0.228
		(2)	(2)	(4)	(13)	(21)
	Top	0.022	0.033	0.044	0.054	0.152
		(2)	(3)	(4)	(5)	(14)
	$\sum$	0.174	0.174	0.337	0.315	1.000
		(16)	(16)	(31)	(29)	(92)

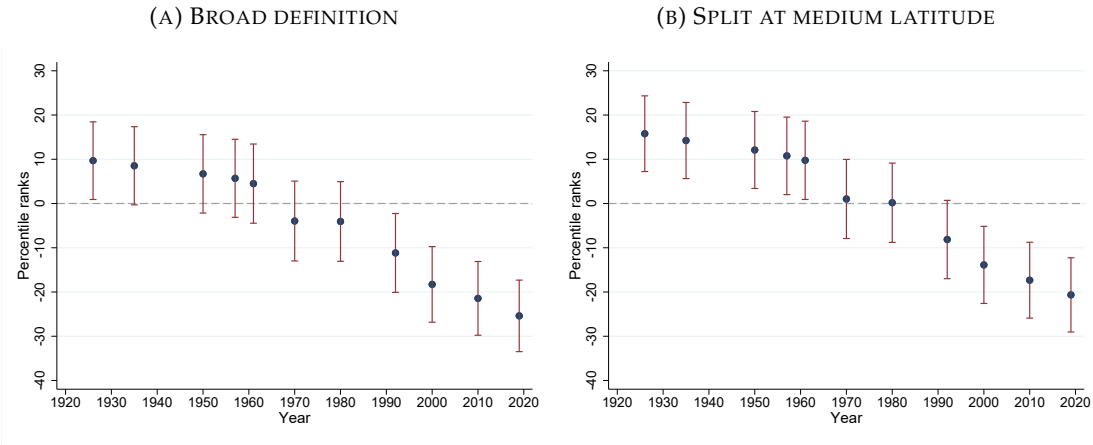
Notes: The table compares positions in the income distribution of West German labor markets in 1926 and 2019. Panels (a) and (b) show transitions for labor markets located in North and South Germany, respectively. Entries are frequencies, expressed in row percentages. The count for each cell is in brackets. Cells shaded in green (red) indicate labor markets rising from the bottom (top) to the top (bottom) half of the income distribution.

FIGURE 2.A3: CHANGES IN THE RELATIVE INCOME POSITION, 1926-2019



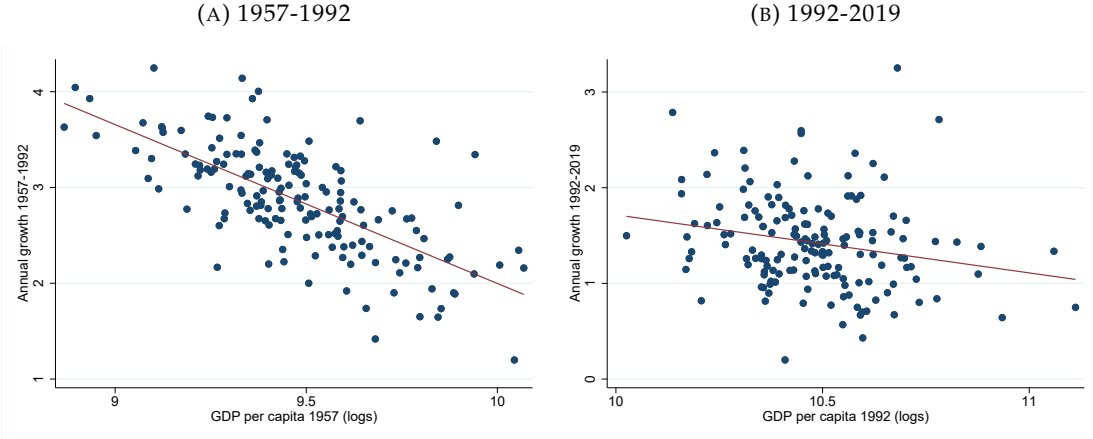
Notes: The figure shows changes in the relative income position between 1926 and 2019. Labor markets shaded in dark green (red) are those rising from the bottom (top) to the top (bottom) half of the income distribution. Labor markets shaded in light green (red) are those that are in the top (bottom) half of the income distribution in both years.

FIGURE 2.A4: PERCENTILE RANK DIFFERENCES BETWEEN NORTH AND SOUTH GERMAN LABOR MARKETS, ALTERNATIVE CLASSIFICATIONS, 1926-2019



Notes: The figure plots the $\dot{\beta}_t$ coefficients from OLS estimations of equation (2.2). Point estimates are marked by a dot. The vertical bands indicate the 95% confidence interval of each estimate. Panel (a) classifies labor markets located in Bremen, Hamburg, Lower Saxony, North Rhine-Westphalia, Schleswig-Holstein, and the northern parts of Hesse and Rhineland-Palatinate as North Germany. Southern labor markets are those in Bavaria, Baden-Württemberg, and the southern parts of Hesse and Rhineland-Palatinate. Panel (b) uses latitude to assign regions. Those with above-mean latitude are classified as North Germany.

FIGURE 2.A5: β-CONVERGENCE FOR TWO SUB-PERIODS



Notes: The figures plot annual growth in real GDP per capita on the y-axis against initial real GDP per capita, along with the linear regression line. Panel (a) does so for 1957-1992, panel (b) for 1992-2019. Each dot represents a labor market.

Robustness checks. Table 2.A3 reports the results of our robustness checks. Panel (A) reproduces our baseline results on the effect of early industrialization on economic development from columns (2), (4), and (6) of Table 2.3.

First, we add additional control variables to our baseline specification (see panel B). These control variables include distance to the inner-German border, which separated West from East Germany between 1949 and 1990, location at the coast, distance to coast and rivers, soil quality, and average sunshine duration. Geographic and climatic conditions might affect land productivity and thus both the regional industrialization process and aggregate productivity. Second, we vary the estimation sample (panel C). We exclude the Ruhr region, Germany's old industrial heartland, and the Free Hanseatic cities of Bremen, Hamburg and Lübeck, focal points of the industrialization in northern Germany and federal states in the German Empire. Third, we construct the instrument using alternative cost vectors for the least-cost paths to the coalfields (panel D). The alternative costs vectors use squared transportation costs, consider only rivers that are at least 20 meters wide and two meters deep, and place higher costs on river and road transport than our baseline vector (following Bairoch, 1990). Fourth, as labor markets vary widely in size, we estimate weighted regressions, using the 1882 population and land area as weights (panel E). Fifth, we use log GDP per capita as our dependent variable and only consider the 1882 employment share in core industrial occupations as main explanatory variable (panel F). Core occupations, pivotal for Germany's early industrialization process, include those in coal mining, iron and metal processing, construction of machines, and the textile industry. Our main result proves robust in all of these checks: Early industrialization has a beneficial effect on economic development in the medium term, but a detrimental effect in the long term.

The final robustness check in panel (F) sheds additional light on the effect size by using levels of sales (1926) and GDP (1957, 2019) per capita as dependent variables (rather than percentile ranks). According to the estimates, a one standard deviation increase in the 1882 industrial employment share increased 1926 sales per capita and 1957 GDP per capita by 0.19 and 0.15 log points, respectively. However, it decreases current GDP per capita by 0.09 log points.

TABLE 2.A3: ROBUSTNESS CHECKS OF 2SLS ESTIMATES

	1926 (1)	1957 (2)	2019 (3)	1st stage F-stat. (4)
(A) Baseline specification				
Baseline specification	13.19***	16.75***	-14.33***	23.58
	(3.80)	(3.12)	(5.07)	
(B) Additional control variables				
...addding distance to inner-German border (logs)	13.62***	15.48***	-15.26***	22.63
	(4.10)	(3.18)	(5.40)	
...adding location at coast (0/1)	13.03***	16.81***	-13.95***	23.45
	(3.69)	(3.14)	(4.98)	
...adding control for soil quality	9.38**	13.72***	-17.78***	22.96
	(4.14)	(3.26)	(5.71)	
...adding controls for log distance to	9.39***	16.22***	-12.96***	31.04
coast and rivers	(2.70)	(2.53)	(4.23)	
...adding control for sunshine hours	9.38**	13.72***	-17.78***	18.90
(mean 1991-2020)	(4.14)	(3.26)	(5.71)	
...all of the controls above	12.09**	15.97***	-15.75**	14.16
	(4.95)	(4.09)	(6.74)	
(C) Different samples				
...excluding Ruhr valley	20.34***	19.60***	-19.84**	11.25
	(6.42)	(5.78)	(9.73)	
...excluding Free Hanseatic cities	13.33***	16.69***	-14.58***	23.44
	(3.79)	(3.14)	(5.12)	
(D) Alternative cost vectors for the instrument				
...using squared transportation costs	10.34***	14.43***	-18.63***	30.30
	(3.23)	(2.73)	(5.15)	
...considering only rivers at least 20m wide	7.26**	14.84***	-14.89***	29.58
and 2m deep	(3.07)	(2.61)	(4.31)	
...based on Bairoch (1990)	6.29**	13.14***	-18.10***	23.75
	(3.08)	(2.60)	(4.83)	
(E) Weighted regressions				
...weighted by 1882 population	9.01***	11.21***	-11.79***	46.58
	(3.36)	(3.02)	(4.32)	
...weighted by area	8.25	12.39*	-22.51***	25.83
	(7.27)	(6.91)	(8.71)	
...using Conley SEs (cut-off: 100 km)	13.19***	16.75***	-14.33***	29.13
	(0.45)	(1.47)	(5.26)	
(F) Independent and dependent variable				
...1882 employment share in key industries	12.31***	15.95***	-13.65***	19.88
as indep. variable	(4.64)	(3.92)	(5.15)	
...Log turnover/GDP per capita as dep. variable	0.189***	0.145***	-0.088***	23.58
	(0.055)	(0.026)	(0.033)	

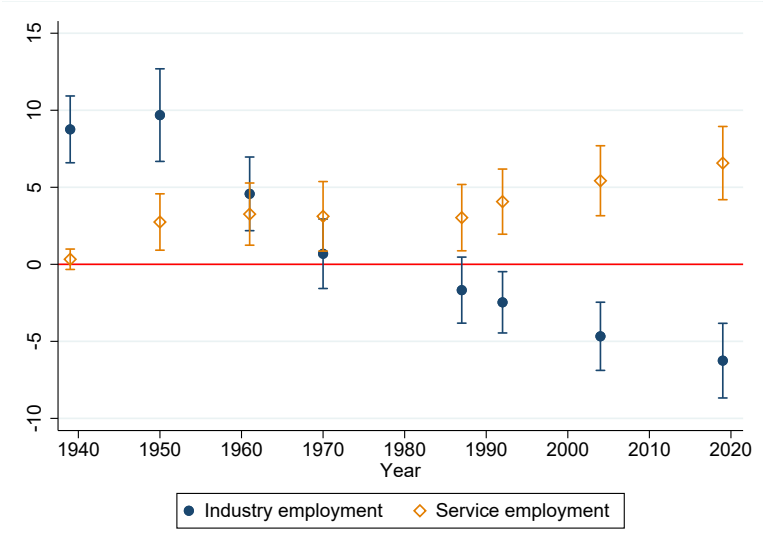
Notes: The table reports 2SLS estimates of the $\ddot{\beta}_t$ coefficient in equation (2.4). The dependent variable is the percentile rank in the income per capita distribution in 1926 (column 1), 1957 (column 2), and 2019 (column 3). All regressions in panels (A) to (F) include land accessibility and the number of towns per area in 1700 as control variables. Regressions in panel (B) add additional variables to our set of controls. Regressions in panel (C) vary the estimation sample. Regressions in panel (D) vary the cost vectors for sea, river and overland transport used for constructing the instrumental variable. Regressions in panel (E) estimate weighted regressions, using population in 1882 and land area as weights. Regressions in panel (F) change the dependent and main explanatory variable. Key industries include coal mining, machines, textile, iron and metal processing. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 2.A4: EFFECTS OF EARLY INDUSTRIALIZATION ON TERTIARY EDUCATION

	Population share w/ university degree (%)		
	(1) 1970	(2) 1987	(3) 2011
Employment share industry 1882	-0.138	0.126	0.151
	(0.094)	(0.206)	(0.451)
N	163	163	163

Notes: The table reports results from 2SLS regressions of the effect of early industrialization on the population share with a university degree (measured in percent). The data come from the population censuses 1970, 1987 and 2011. The 1882 employment share in industry is standardized with a mean of zero and a standard deviation of one. All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

FIGURE 2.A6: THE EFFECT OF EARLY INDUSTRIALIZATION ON THE EMPLOYMENT SHARES IN INDUSTRY AND SERVICES, 1939-2019



Notes: The figure plots the coefficient estimates from separate 2SLS regressions of the employment share in industry (blue) and services (yellow) in different years (1939, 1950, 1961, 1970, 1987, 1992, 2004, 2019) on the 1882 industrial employment share (in %). Point estimates are marked by a dot. The vertical bands indicate the 95% confidence interval of each estimate. The 1882 employment share in industry is standardized with a mean of zero and a standard deviation of one. All regressions include land accessibility and the number of towns per area in 1700 as control variables.

TABLE 2.A5: EARLY INDUSTRIALIZATION, ECONOMIC STRUCTURE, AND POLITICAL OUTCOMES

	Economic structure					Political outcomes		
	Location of top-100 firm (0/1) 1957 (1)	Empl. share in firms w/ 500+ employees (%) 1970 (2)	HHI index of industry concentration 1950 (3)	Self-employment share (%) 1950 (4)	Avg. annual earnings in industry (100DM) 1951 (5)	Years w/ major from dominant party 1950-90 (6)	Years w/ Social Dem. major 1950-90 (7)	Vote share Social Democrats (%) 1957 (8)
Empl. share industry 1882	0.216***	4.098***	5.658***	-3.006***	4.673***	6.241***	4.687**	3.418***
	(0.0611)	(1.139)	(1.943)	(0.509)	(0.796)	(1.402)	(1.930)	(0.847)

Notes: The table shows the results of 2SLS regressions of the effect of early industrialization on the probability of having at least one of the 100 largest firms in the labor market in 1957 (column 1), the share of employment in firms with more than 500 employees in 1970 (column 2), the sectoral concentration of industrial employment in 1950 (column 3), the self-employment share in 1950 (column 4), average annual earnings in industry in 1951 (column 5), the number of years the major was member of the locally dominant party in 1950-1990 (column 6), the number of years the major was member of the Social Democrats in 1950-1990 (column 7), and the vote share of the Socials Democrats in the national election of 1957 (column 8). We measure employment concentration by the Hirschman-Herfindahl-Index (with $\alpha = 2$). The 1882 employment share in industry is standardized with a mean of zero and a standard deviation of one. All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 2.A6: EARLY INDUSTRIALIZATION AND REVERSALS OF FORTUNES

	Negative reversal (0/1)		Positive reversal (0/1)	
	1926-2019	1957-2019	1926-2019	1957-2019
	(1)	(2)	(3)	(4)
Employment share industry 1882	0.198***	0.267***	-0.176***	-0.108**
	(0.075)	(0.077)	(0.054)	(0.043)
Outcome mean	0.245	0.209	0.245	0.209

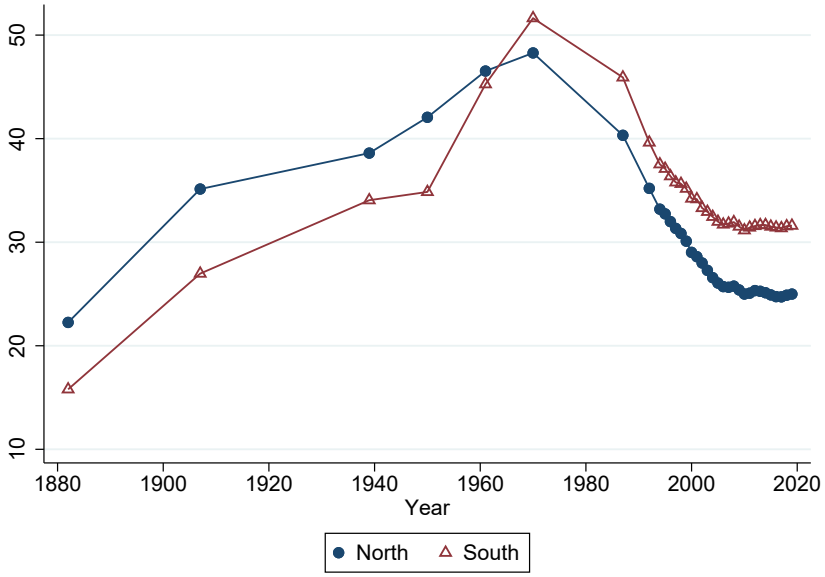
Notes: The table shows results from 2SLS regressions of the effect of early industrialization on the probability of experiencing a reversal of fortune. The dependent variable is a dummy variable indicating a negative (columns 1 and 2) or positive (columns 3 and 4) reversal. We say that a labor market has experienced a negative (positive) reversal if it moved from the top (bottom) half of the income distribution to the bottom (top) half in 2019. Columns (1) and (3) take the rank in 1926 as the starting point, columns (2) and (4) the rank in 1957. The 1882 employment share in industry is standardized with a mean of zero and a standard deviation of one. All regressions include land accessibility and the number of towns per area in 1700 as control variables. Robust standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% percent level, respectively.

TABLE 2.A7: DECOMPOSITION OF CHANGES IN σ_{y_t}, 1957-2019

	1957-1980	1980-2019	1957-2019
	(1)	(2)	(3)
Total change	-0.073	0.030	-0.043
Of which due to:			
change in $\ddot{\beta}_t$	-0.080	-0.018	-0.098
remainder	0.007	0.048	0.055

Notes: The table decomposes the change in σ_{y_t} into two components, the effect of changes in $\ddot{\beta}_t$ and a remainder. See footnote (27) for details.

FIGURE 2.A7: INDUSTRIAL EMPLOYMENT SHARES IN NORTH AND SOUTH GERMANY (%), 1882-2019



Notes: The figure plots the employment share of the labor force in industry (in %), separately for North and South Germany.

Chapter 3

The Integration of Migrants in the German Labor Market

Joint work with Jan Stuhler

A slightly modified version of this chapter has been circulated as discussion paper under the title "The Integration of Migrants in the German Labor Market: Evidence over 50 Years" (Berbée & Stuhler, 2023).

My individual contribution within the coauthors' team includes: Conceptualization; Methodology; Software; Validation; Formal Analysis; Investigation (data preparation, data harmonization, and the empirical analysis); Data Curation; Writing – Original Draft; Writing - Review & Editing; Visualization. (Contributor Role Taxonomy, CRediT, see Brand et al., 2015)

3.1 Introduction

Immigration ranks among the most debated policy issues in Europe, and migrant flows are likely to remain high for decades to come (Hanson & McIntosh, 2016). The German case is particularly interesting: Since the recruitment of the first so-called "guest workers" in the late 1950s, Germany gradually became the world's second-most important migrant destination in absolute numbers (after the US). By 2021, the share of foreign-born reached 17.1%, rising to 27.3% when including second-generation migrants (DESTATIS, 2021).[1] They form an integral part of Germany's economy, but the realization that Germany has become a classic immigration country ("Einwanderungsland") is quite recent. Most immigration episodes took Germany by surprise and were accompanied by controversial political debates[2] rather than positive narratives about the opportunities of immigration. Contrary to other destination countries, it took until the 2000s for Germany to adopt explicit integration policies for immigrants. Accordingly, their labor market integration was long neglected by policy makers and, until the 1990s, only marginally discussed by researchers – partly due to the lack of suitable data.

In this paper, we provide comprehensive evidence on the labor market integration of immigrants in West Germany over the last 50 years. For that purpose, we use cumulated data from 30 waves of the *microcensus*, an administrative survey that covers 1% of the resident population in Germany in each of its waves – resulting in more than 800,000 individual observations in recent years. Compared to more commonly used sources[3], the (pooled) microcensus combines three key advantages: it is representative of the total population, including the self- and non-employed (unlike social security registers and derived data sets); it offers large sample sizes (unlike surveys such as the Socio-Economic Panel, SOEP); and immigrants are included right after arrival, not only when entering the labor force or when refreshment samples are taken. Although being the best data source to study the long-run integration of different immigrant groups in Germany, only Sprengholz et al. (2021) have used a comparably broad set of waves from the microcensus. While we focus on the labor market integration of male immigrants (to abstract from cultural differences in female labor supply), Sprengholz et al. (2021) and Lee, Peri & Viarengo (2022) provide evidence on the gender dimension of immigration that is complementary to our work.

In the first part of our study, we provide a broad overview on the labor market integration of different immigrant groups in Germany (Section 3.4). We distinguish 36 different immigrant "cohorts" defined by time of arrival and region of origin, and track their *employment* and individual *income* (including non-labor income and welfare benefits). As

[1] Among the population younger than 20, numbers are even higher: 38.9% have a migration background.

[2] Recurring topics in these debates include wage dumping ("Lohndumping"), asylum abuse ("Asylmissbrauch") and pressure on the welfare state resulting from poverty immigration ("Armutszuwanderung").

[3] Our choice of data source distinguishes our study from earlier work, which has primarily been based on the Socio-Economic Panel (SOEP, e.g., Kogan, 2004; Riphahn, 2004; Constant & Massey, 2003; Basilio, Bauer & Kramer, 2017), social security records (Lehmer & Ludsteck, 2015; Gathmann & Monscheuer, 2022) or up to three waves from the microcensus (Algan, Dustmann, Glitz & Manning, 2010; Kalter & Granato, 2002; Kogan, 2011). Limitations of the microcensus data are discussed in Section 3.3.1.

we are interested in the overall labor market gaps between natives and immigrants, we first focus on unconditional comparisons, i.e. the difference to German nationals of similar age, without controlling for other covariates like education or for return migration – a change in the labor market gap due to selective return migration would be part of the "net" effect that we aim to capture. Depending on the question asked, conditional comparisons and evidence on the mechanisms that contribute to integration trajectories are of course highly relevant, but are not the focus of this study.

Some of our findings are consistent with prior results from Germany and other countries. Integration profiles tend to be concave, with rapid gains in employment and income in the first years after arrival. Low initial earnings reflect the well-known "downgrading" (Eckstein & Weiss, 2004; Dustmann, Schönberg & Stuhler, 2016) of immigrant arrivals compared to natives of similar education and work experience, due to the lack of country-specific skills (Chiswick, 1978; Borjas, 1985, 1995), but also the disproportional sorting of immigrants into small and low-paying firms (Arellano-Bover & San, 2020). Over time, immigrant's labor market outcomes tend to improve as they acquire more country-specific experience, and move to better jobs and firms (Lehmer & Ludsteck, 2015; Gathmann & Monscheuer, 2022). The extent of this convergence – whether immigrants *fully* catch up with their native counterparts – and how this pattern has changed across arrival cohorts remains however debated, both for the US (e.g. Card, 2005; Borjas, 2015) and Germany.[4]

Integration trajectories differ however widely, not only between origins, but also between arrival periods. Most groups have substantially lower employment rates than natives of comparable age. Recent arrivals from low-income countries and the former Eastern Bloc experience larger initial gaps, but also faster employment and income growth compared to the earlier "guest worker" cohorts (Sprengholz et al., 2021; Gathmann & Monscheuer, 2022; Lehmer & Ludsteck, 2015; Gundel & Peters, 2008).[5] As others, we find that refugees experience large initial gaps, but tend to catch up to other immigrants eventually (Fasani, Frattini & Minale, 2021b; Brell et al., 2020). Arrivals from the Middle East and Africa experience particularly low employment rates. While the employment gaps vary widely, the income gaps are large for all groups; the only exception are immigrants from North-West Europe, who increasingly outperform natives. These gaps in employment and income decrease in the second generation, but do not close fully (Algan et al., 2010). While income gaps shrink by more than 70%, the employment gaps remain large – in particular for those cohorts that already struggled most in the first generation.

Other findings are however more novel, and differ from the corresponding patterns

[4] While most earlier studies on the cohort of "guest workers" and their families did not find wage assimilation (Schmidt, 1997,Bauer, Dietz, Zimmermann & Zwintz, 2005), more recent studies tend to conclude that with the duration of stay, wage and employment gaps of immigrants compared to natives decline (Gathmann & Monscheuer, 2022; Fertig & Schurer, 2007; Lehmer & Ludsteck, 2015; Sprengholz et al., 2021; Constant & Massey, 2005).

[5] Wiedner & Giesecke (2022); Gathmann & Monscheuer (2022); Gundel & Peters (2008); Riphahn, Sander & Wunder (2013) comment on the particularly unfavorable labor market integration of Turkish males, exhibiting none or very low levels of assimilation.

for the US. First, we find only partial convergence in employment, with large gaps remaining for most immigrant groups. The average employment gap ten years after arrival is about 10 percentage points (compared to a baseline employment rate of similarly aged German men of 91%), with little further progress in subsequent years. Consistent with these employment gaps, welfare dependency is much higher among immigrants. Second, the income gaps between immigrants and natives start to widen again after some years in the host country (i.e., *divergence* rather than convergence). This is at odds with earlier studies on wage convergence based on the SOEP, which hypothesized that wages assimilate fully after abound 20 years (Gundel & Peters, 2008; Constant & Massey, 2005; Beyer, 2019) or less (Fertig & Schurer, 2007).[6] And third, we document that the integration profiles are frequently non-monotonic, with some groups experiencing a persistent – and sometimes sharp – decline in employment after many years in the country.[7]

We augment these general findings with more targeted evidence on specific questions. Studying the heterogeneity in integration outcomes across cohorts, we first ask how *predictable* integration profiles are (Section 3.5). We show that *cohort*-level characteristics, i.e. the average characteristics of all migrants from a given cohort are predictive of *individual* trajectories, even conditional on an individuals' own characteristics. Indeed, most of the variation in integration outcomes can be explained by a small set of cohort characteristics set before arrival (in particular education or refugee shares) or shortly after arrival (such as initial employment gaps or local economic conditions). Differences in integration outcomes between immigrant groups are therefore highly predictable – as are the labor market prospects of new arrivals.

We next test whether those integration outcomes have improved or worsened over the past five decades (Section 3.6). The raw employment gap 10 year after arrival has widened substantially – by 3.3 percentage points for each decade, corresponding to a widening of more than 15 pp. over five decades. However, this systematic worsening can be fully explained by compositional changes and changing economic conditions. Controlling for education, refugee share and unemployment, the estimated long-term trend is close to zero – after abstracting from changes in composition, integration outcomes have remained remarkably stable over the past five decades. Still, this "null result" is disappointing: Hopes that integration outcomes would improve over time, as German institutions gain experience and policies adapt to the needs of an "Einwanderungsland", have remained unfulfilled so far.

We conclude our study with case studies of two particularly interesting episodes. First, we document a striking employment collapse in the early 1990s, in particular among earlier arrivals from Turkey: after a long spell of high employment, their employment

[6] These studies estimated conditional immigrant-native gaps, but could not observe complete assimilation paths over the entire duration of stay of the respective cohorts, and the SOEP contains only few observations in the first years after arrival.

[7] The findings of wage divergence over the life-cycle and high sensitivity of migrants to economic shocks are in line with predictions from segmented labor market theory (Doeringer & Piore, 1971) that assumes that migrants work in a secondary labor market that lacks labor protection and is very sensitive to economic shocks. For empirical evidence from Germany, see also Kogan (2004) and Dustmann et al. (2010).

rate collapsed by nearly *30 percentage points*. We show that in particular a structural decline of immigrant-intensive industries contributed to this collapse. This episode is in line with earlier findings of migrants being disproportionally sensitive to macroeconomic shocks (Kogan, 2004; Barth, Bratsberg & Raaum, 2004; Bratsberg et al., 2006; Dustmann et al., 2010; Bratsberg et al., 2010), but the scale and speed of the employment loss is striking. It also has important implications: labor market integration is not a one-way street, and policy makers have to worry not only about the successful integration of new immigrant arrivals, but also the potential for sudden evaporation of those gains in later years – a particular concern in the face of potential labor market shocks related to the 2020 global pandemic and the 2022 Russo-Ukrainian War.

Finally, we compare the labor market integration of recent refugee cohorts who arrived to Germany after the 2015 European refugee "crisis" and the 2022 Russo-Ukrainian war. Consistent with findings by Brücker, Kosyakova & Schuß (2020), we find that the 2015 cohort integrated more quickly into employment than earlier refugees. However, we also show that these favorable integration outcomes were likely due to the unusually favorable economic conditions, with the unemployment rate reaching a historic low in 2018. Abstracting from differences in economic conditions, we find that the 2015 cohort integrated slightly less rapidly than earlier arrivals. To conclude our study, we predict their likely future path of employment under different counterfactual scenarios. We perform a similar analysis for Ukrainian refugees; owing to their high educational attainment, they have a comparatively good labor market outlook.

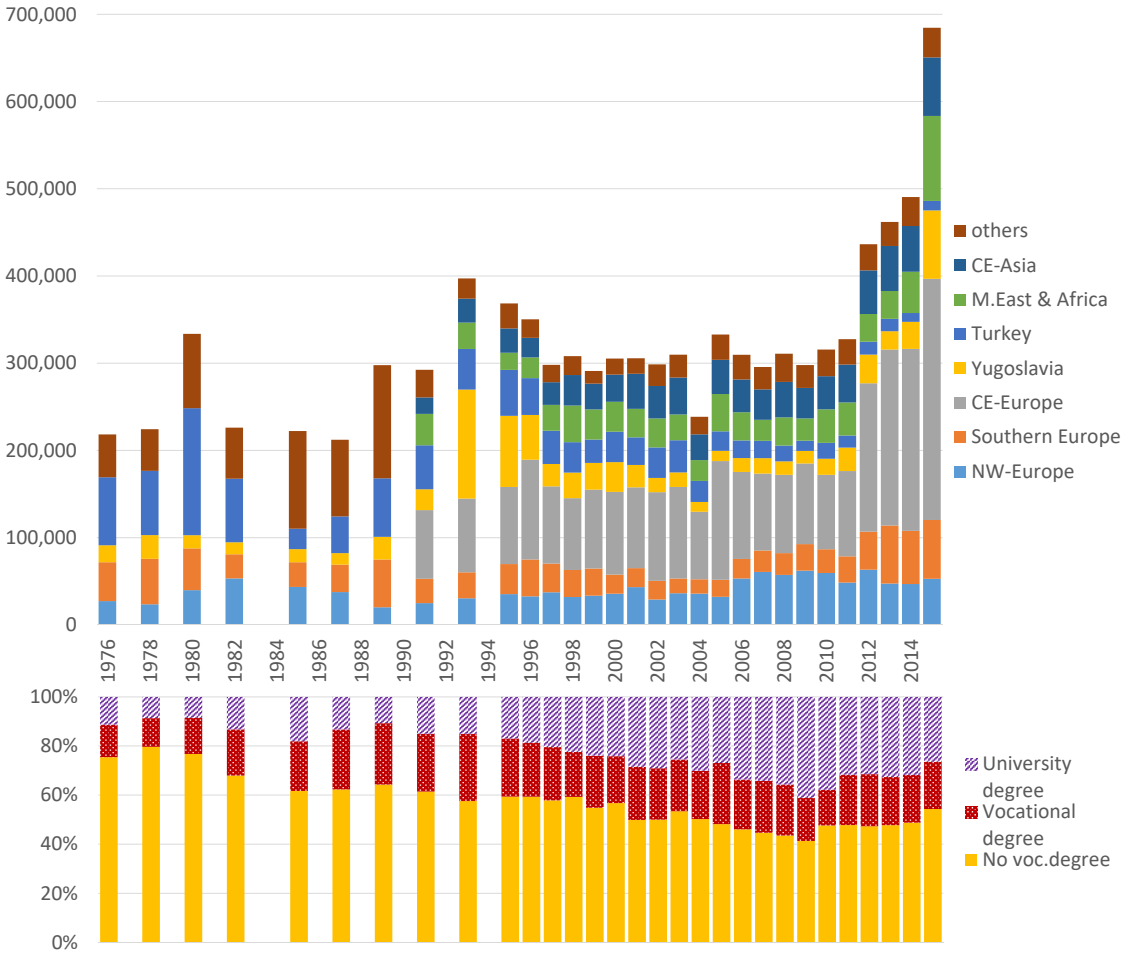
3.2 Immigration to Germany since the 1950s

Germany became one of the most important destinations for international migrants in recent decades, but as Figure 3.1 illustrates, migrant inflows have been unsteady and highly heterogeneous: arrivals have strongly increased since the the mid-1970s, with peaks in the early 1990s and around 2015. Not only the regions of origin have changed over time, but also their educational composition, with increasing shares of immigrants who hold university degrees. We provide a brief overview of the most important immigration episodes here, while Appendix 3.A.1 provides more information on the institutional and legal aspects of migration and integration policy over time.[8]

The first important episode of international immigration after World War II consisted of so-called "guest workers", who were recruited by German manufacturing firms during the economic boom of the 1960s and early 1970s from countries in Southern Europe and Turkey. They were composed primarily of young men with low formal education, and were expected to stay only temporarily, so that little effort was put into their social integration. Nevertheless, a considerable share eventually brought their families to Germany and did not return, even after recruitment stopped during the economic downturn in 1973. As unemployment increased and social tensions rose during the following

[8] Bauer et al. (2005) provide a comprehensive overview about immigration to Germany until the early 2000s.

FIGURE 3.1: IMMIGRATION TO GERMANY 1976-2015



Notes: Microcensus, foreigners who have migrated to Germany within the past year, regardless of gender and age. Upper panel: Total numbers (extrapolated to the total population using extrapolation weights). Lower panel: Shares by education. Prior to 1991 the category "others" includes immigrants from Central and East Asia and the Middle East and Africa.

decade ("consolidation period"), the political response focused on restricting further immigration and supporting return migration (Bade & Oltmer, 2004; Dustmann, Bentolila & Faini, 1996). Consequently, fewer new immigrants arrived and their composition shifted from labor migration to family reunification, which was for many years the only way of legally obtaining residence for non-EU citizens except for the asylum system and the naturalization of ethnic Germans.

During the 1980s, the number of humanitarian arrivals from Eastern Europe, but also countries such as Vietnam and Iran started to increase. As a response, policies were introduced to curb access to humanitarian protection (Münz, 1997; Herbert, 2001). This led to a temporary drop in asylum applications, before the number started to rise again in the 1990s during the Yugoslav Wars and as the Kurdish-Turkish conflict intensified. Around the fall of the Iron Curtain and German reunification, international migration in Germany experienced a second peak, primarily driven by immigrants from the former Eastern Block, including large numbers of ethnic Germans, but also seasonal workers,

cross-border commuters and so-called "posted workers" (*Werkvertragsarbeitnehmer*). The initial enthusiasm in facilitating temporary forms of immigration to address high labor demand following reunification turned however into a more hostile political climate following the 1993 recession and complaints about a violation of labor standards and "wage dumping" (Amior & Stuhler, 2022).

Since the late 1990s German migration policy underwent important changes that acknowledged the changing perception of Germany as an "immigration country": In 1999/2000, a reform of the citizenship law allowed second-generation foreigners to adopt the German nationality. The immigration act of 2005 ("Zuwanderungsgesetz") opened the German labor market for high skilled foreigners. In contrast to previous legislation, it explicitly envisaged integration measures like language courses. Since the 2000s, immigration from other EU member states became increasingly important, in particular after the EU enlargements in 2004 and 2007. To address fears about increasing labor market competition, Germany decided to temporarily restrict labor market access for citizens of these states until 2011 (Boeri & Brücker, 2005).

As a consequence of armed conflicts in Afghanistan and the Arabic World, arrivals of asylum seekers increased again, peaking in 2015. Overall, about 1.1 million asylum seekers reached Germany in the years 2015-2016. The public response to this sudden migration wave has been polarized, ranging from broad solidarity with newly arrived refugees to sharp criticism and protests. Most recently, as of November 2022, more than one million Ukrainians have been registered as refugees following the Russian invasion in February 2022, with women and children representing the majority.

3.3 Data and Empirical Approach

3.3.1 The German Microcensus

For our analysis we use cumulated data from 30 waves of the German microcensus (*Mikrozensus*) that cover the years 1976-2015 (RDC, 2015). The microcensus is an annual survey of a representative 1%-sample of the resident population. This means that in recent years, about 380,000 households with 820,000 individuals participate. The survey is part of the German official statistics and respondents are obliged by law to provide information for the majority of the questions.[9] The topics covered in the questionnaires include socio-economic background, household composition and detailed information on employment and income. We use the factually anonymized 70% sub-samples from the original microcensus that are provided as Scientific Use Files for the years 1976, 1978, 1980, 1982, 1985, 1987, 1989, 1991, 1993 and all years between 1995 and 2015.

As already mentioned, the microcensus offers several useful features compared to other sources: It is representative of the total population, including self-employed and

[9] However, interpreters are not provided. In case of linguistic difficulties, interviewers and respondents have to find a workaround, e.g. by switching to English or consulting with other household members. Despite the legal obligation to provide answers to the questionnaire, this might affect the representativeness for some immigrant groups (see Marbach, Hainmueller & Hangartner, 2018), and generate an upward bias in their estimated labor market status (assuming that German language skills improve labor market outcomes).

persons outside the labor force (unlike social security registers and derived data products, such as SIAB) while at the same time offering very large sample sizes (unlike surveys such as the Socio-Economic Panel, SOEP). In contrast to these other two datasets, immigrants are included right after their arrival and not only when they enter the labor force or when refreshment samples are taken. For these reasons and because it offers comparable questionnaires over more than 40 years[10], the microcensus is the best-suited available data source to study the long-run integration of different immigrant groups in Germany.

However, the microcensus also has important limitations: First, it consists of repeated cross-sections, so that we cannot track any particular individual over time. Instead, cohorts are defined by arrival year and nationality (synthetic cohorts). One consequence is that we cannot directly account for selective return migration, which can bias individual assimilation profiles from repeated cross-sections (Lubotsky, 2007; Dustmann & Görlach, 2016). We are not very concerned about this limitation for several reasons. Our primary interest is on the integration of different arrival cohorts rather than individual profiles, so compositional changes due to return migration would contribute the overall gaps that we aim to capture. Moreover, previous work using panel data suggests that in contrast to the US case, return migration on average does not strongly bias cross-sectional estimates of immigrants' labor market assimilation in Germany (Constant & Massey, 2003; Fertig & Schurer, 2007; Lehmer & Ludsteck, 2015).[11] Finally, by tracking the overall size of a cohort we can gauge the potential importance of return migration for different cohorts and points in time (for more details see Appendix Table 3.A1).

Second, the microcensus collects information about nationality, not country of birth. This implies that in the earlier waves, we cannot consistently identify immigrants who have obtained the German citizenship and thereby lost their former nationalities (see Appendix 3.A.2). In particular, this study does not cover ethnic Germans ("Spätaussiedler") that were granted citizenship upon arrival.[12] For other groups, our results could be biased if selective naturalization affects their composition over time. However, since 2005, the microcensus also asks about previous nationalities so that we can infer how many immigrants from different cohorts eventually naturalize, and whether they differ with respect to their labor market performance from other immigrants. In Appendix 3.A.2 we show that, naturalization is a relatively minor issue and changes the aggregate outcomes of cohorts only marginally.[13]

[10] The questionnaire has been gradually expanded and changed over time, which requires harmonization of some variables. This is not always possible without loss of information, in particular for early waves. We build on valuable harmonization work by Lengerer, Schroedter, Boehle & Wolf (2019).

[11] Nevertheless, Chapter 4 indicates that there are large differences in return migration patterns between origin groups. In particular, (the lack of) return migration has likely contributed to the employment collapse of Turks in comparison to other migrant groups in the early 1990s. (Kuhlenkasper & Steinhardt, 2017) provides an overview about the differences in return migration between migrants of different origin countries.

[12] We exclude ethnic Germans and German nationals that are not born in Germany from our native control group whenever we have that information available in the microcensus (since 1999). Before that time, naturalized migrants in the native control group are unlikely to distort average outcomes substantially.

[13] Important exceptions are immigrants from Central-Eastern Europe, early cohorts from Turkey and immigrants who arrived from the Near and Middle East around 1990. For these groups, we observe well their

3.3.2 The Socio-Economic Panel (SOEP)

To approximate the share of refugees for each cohort we use the Socio-Economic Panel (SOEP), which features much smaller sample sizes but more information on individual characteristics. To consider recent asylum seekers (Section 3.7.2) we additionally use the IAB-BAMF-SOEP subsampleof the SOEP, which covers refugee arrivals between 2013 and 2016. Specifically, we use the survey waves 2016 to 2019 and extrapolate backwards employment in 2015 based on retrospective questions. Similar to the microcensus, the SOEP is representative of the population and contains a broad variety on questions on employment, wages and socio-economic background. However, (i) asylum seekers are strongly oversampled and (ii) information on the reasons for migration and asylum applications are included.

3.3.3 Definition of Immigrant Cohorts

We limit our analysis to males in working age (18-58 years) living in West Germany, including Berlin.[14] We keep only first-generation migrants that have at least one foreign nationality.[15] We focus on men to abstract from cultural differences in labor supply, and the resulting large variation in female employment between immigrant groups. Moreover, Sprengholz et al. (2021) and Lee et al. (2022) already provide a comprehensive discussion of the long-run labor market integration of immigrants from a gendered perspective. We exclude immigrants who arrived at ages younger than 18, because younger migrants are likely to enter the education system and we want to track labor market outcomes from the first day of arrival. Germans that are born in Germany and do not possess a second nationality are the reference group.

We divide immigrants into 36 distinct *cohorts* based on origin regions and arrival periods, defined such as to keep sufficient observations for each cohort over time. We drop those who do not belong to any of these cohorts (4.3 per cent of all immigrants in 2015). Table 3.1 provides an overview. Cohort characteristics are taken from the first available wave after the complete cohort arrived (e.g., the 1995 microcensus for the 1988-95 cohorts). The implied cohort size in the total population varies between 34,000 and 135,000. The age at migration varies surprisingly little, with a mean of 29.26 and a standard deviation of about 1.73 years across immigrant cohorts, while educational attainment varies substantially.

initial outcomes (before naturalization) and long-run outcomes (once the microcensus contains information on previous nationalities and naturalizations), but not their mid-career outcomes.

[14] While only West Berlin is included in earlier years, the entire city of Berlin is included after German reunification. This change is negligible for our analysis, because this study only covers Eastern European and Asians who arrived after the fall of the Iron curtain. These origin regions accounted for at least 90% of all migrants in East Berlin in the late eighties and will therefore not show up in this analysis for West Germany. We chose to keep (West) Berlin in our sample, because it is home to sizeable immigrant communities (in particular Turkish).

[15] By doing so, our definition of immigrants is consistent over the entire time span, although we have the data on naturalized immigrants available since 2005. As pointed out in Appendix 3.A.2, for the vast majority of cohorts, the differences in aggregate labor market outcomes are negligible whether we include naturalized immigrants or not.

TABLE 3.1: DEFINITION AND CHARACTERISTICS OF IMMIGRANT COHORTS

	Cohort size (extrapolated)		Age at migration	Share university degree (%)		Refugee share
	arrival	10 yrs.	(mean)	arrival	10 years	(%)
1. Recruitment period (1955-1973)						
North-West Europe 55-73	82,000	56,000	27.7	24.5	22.3	0
Italy 55-67	-	82,000	27.2		1.2	0
Italy 68-73	67,000	50,000	28.7	3.2	1.1	0
Turkey 55-67	-	73,000	28.7		1.4	0
Turkey 68-70	-	118,000	29.7		1.8	0
Turkey 71-73	135,000	110,000	29.5	2.3	2.1	0
Yugoslavia 68-70	-	135,000	27.7		2.4	0
Yugoslavia 71-73	64,000	57,000	28.1	0.9	3.0	0
Other recruitment states 55-67	-	91,000	28.1		2.5	0
Other recruitment states 68-73	139,000	75,000	29.4	1.6	2.1	0
2. Consolidation period (1974-1987)						
North-West Europe 74-87	58,000	45,000	28.3	22.0	26.3	0
Southern Europe 74-78	53,000	25,000	28.8	7.6	5.0	0
Southern Europe 79-87	45,000	26,000	27.3	9.0	6.7	0
Yugoslavia 74-87	34,000	19,000	29.2	4.9	8.2	13
Turkey 74-78	55,000	31,000	30.2	8.1	5.7	0
Turkey 79-87	52,000	41,000	25.7	7.2	5.0	6
3. Fall of the Iron Curtain (1988-1995)						
North-West Europe 88-95	50,000	41,000	30.4	48.3	34.4	0
Southern Europe 88-95	81,000	60,000	29.8	10.0	6.1	2
Centr.-East Europe 88-91	41,000	26,000	33.1	29.0	16.8	3
Centr.-East Europe 92-95	89,000	50,000	31.2	25.7	24.6	9
Yugoslavia 88-91	29,000	21,000	29.2	9.6	3.1	41
Yugoslavia 92-95	112,000	57,000	30.6	8.5	7.5	77
Turkey 88-91	48,000	39,000	25.7	8.6	5.8	19
Turkey 92-95	51,000	53,000	26.1	7.7	5.0	29
Mid.East & Africa 88-95	85,000	78,000	27.9	27.9	19.0	57
Central & East Asia 88-95	54,000	41,000	28.5	30.4	14.5	65
4. Period of East-West integration (1996-2005)						
North-West Europe 96-05	103,000	39,000	31.8	50.1	50.5	2
Southern Europe 96-05	59,000	35,000	28.7	28.8	18.9	0
New EU states 96-00	45,000	27,000	31.2	30.4	22.1	4
New EU states 01-05	46,000	43,000	31.3	27.2	22.3	3
Former USSR 96-00	43,000	62,000	33.4	28.5	22.6	36
Former USSR 01-05	77,000	52,000	33.3	26.7	24.7	28
Yugoslavia 96-05	43,000	48,000	28.4	10.4	9.2	46
Turkey 96-05	91,000	83,000	26.4	9.4	7.7	17
Mid.East & Africa 96-05	126,000	96,000	28.7	27.8	29.8	55
Central & East Asia 96-05	60,000	37,000	28.2	64.9	40.9	39

Notes: Cohort sizes and characteristics measured in the first available census wave after the end of the arrival period and 10 years after the end of the arrival period. Total population numbers extrapolated using the extrapolation weights provided by the microcensus. Refugee share taken from the SOEP. See Appendix Table 3.A1 for a precise definition of the origin regions.

3.3.4 Empirical Approach

Non-parametric comparisons. In the first part of our analysis we focus on unconditional, non-parametric comparisons of immigrant cohorts and natives of the same gender and age. Specifically, we predict the (individual) immigrant-native gap

$$\hat{y}_i^{gap} = y_i - \hat{y}_i \tag{3.1}$$

where y_i is the actual outcome of immigrant i and $\hat{y}_i$ is his counterfactual outcome, defined as the average outcome of natives with the same gender, age and observation year. We predict this counterfactual outcome from the regression

$$y_n = \sum_{a=18}^{58} \delta^N A_a + \sum_{t=1976}^{2015} \gamma_t^N \Pi_t + \sum_{t=1976}^{2015} \sum_{a=18}^{58} \zeta_{ta}^N (A_a \times \Pi_t) + \varepsilon_n \tag{3.2}$$

where y_n denotes the labor market outcome y for native n, A_a denotes a set of dummy variables for age $a = [18, ..., 58]$, Π_t denotes a set of indicator variables for each calendar year t, and $A_a \times \Pi_t$ are full interactions of age and calendar year. The superscript N emphasizes that the coefficients are estimated based on our native reference sample as defined in the previous section (working-age men living in West Germany and born in Germany with German but no other nationality[16]).

To compare the integration profiles of different immigrant groups, i.e. arrival cohorts by country of origin and years since migration, we take the group mean of the immigrant-native gaps $\hat{y}_i^{gap}$ (or its components y_i and $\hat{y}_i$). In parts of our analysis we also consider *conditional* immigrant-native gaps that control for education. In that case, we additionally include indicator variables for educational levels interacted with year dummies in equation (3.2). This allows us to abstract from differences in the educational composition, by comparing an immigrant to natives of the same age and with the same educational degree.

Parametric estimates. To study the role of macro-economic conditions and to predict immigration profiles for more recent cohorts we additionally implement a parametric framework that is similar to Borjas (1995) and Bratsberg, Raaum & Røed (2014). Specifically, we model the outcome y_i for immigrant i of immigrant cohort I in calendar year t as

$$y_i = \phi^I X_i + \delta^I A_i + \alpha^I YSM_i + \sum_{t=1976}^{2015} \gamma_t^I \Pi_t + \varepsilon_i \tag{3.3}$$

where X_i a set of socio-economic characteristics, most notably education, A_i a third-order polynomial in age, and YSM_i a third-order polynomial of years since migration. As previously, Π_t denotes a set of indicator variables for each calendar year. The corresponding

[16] Before 1999, we cannot consistently identify whether respondents were born in Germany or not. This means in particular that before 1999 our native control group potentially includes ethnic Germans.

regression model for natives reads:

$$y_n = \phi^N X_n + \delta^N A_n + \sum_{t=1976}^{2015} \gamma_t^N \Pi_t + \varepsilon_n \tag{3.4}$$

If immigrant group I is defined by arrival years, the parameters in equations (3.3) and (3.4) are not jointly identified (because of collinearity between YSM_i and observation year). Therefore, we have to make the additional assumption of identical period effects for immigrants and natives, $\gamma_t^I = \gamma_t^N$. In that case, the predicted immigrant-native gap for immigrant i simplifies to:

$$\hat{y_i}^I - \hat{y}_i^N = (\hat{\phi}^I - \hat{\phi}^N) X_i + (\hat{\delta}^I - \hat{\delta}^N) A_i + \hat{\alpha}^I YSM_i \tag{3.5}$$

In practice, the assumption of equal periods effects is unlikely to hold, as immigrants' labor market outcomes tend to be more sensitive to recessions than natives (Barth et al., 2004; Bratsberg et al., 2006; Dustmann et al., 2010). Following Barth et al. (2004) and Bratsberg et al. (2014) we adjust equations (3.3) and (3.4) in two ways. First, we include in the empirical model a full set of interaction terms between indicators for educational attainment and year of observation, so that period effects differ by attainment. Second, we include the regional unemployment rate and allow for its effect on the outcome y_i to be different for natives and immigrants.

3.4 Integration Profiles over 50 Years

We begin by providing non-parametric evidence on the economic integration of male immigrants over the last five decades. Specifically, we compare the labor market trajectories of immigrant cohorts (defined by arrival year and origin region, see Section 3.3.3) since migration to the corresponding mean trajectories for natives with an equivalent distribution of age and birth year. To measure labor market success we focus on employment and post-tax individual income. We briefly consider other outcomes, such as intermarriage rates and welfare dependence, to provide insight into other dimensions of the integration process that may interact with economic integration.

3.4.1 Results: Employment

Unconditional comparisons. Figure 3.2 plots the average employment rate for different origins by years since arrival, separately for four broad arrival periods (1955-1973, 1974-1987, 1988-1995 and 1996-2005). Our definition of employment includes any kinds of

regular employment and formal education.[17] Immigrants from EU-15 countries (North-West and Southern Europe) are coded blue, non-EU-15 immigrants with a refugee share of less than 50% red, and origin groups with a higher share of refugees green. For comparison, we include the average employment rate of natives of comparable age and birth years (grey line), which corresponds to the prediction based on equation (3.2).[18]

Unsurprisingly, Figure 3.2 shows much heterogeneity between groups. These differences are not only due to differences in "cohort quality" (Borjas, 1985), but may also reflect the specific macroeconomic or policy conditions that immigrants face (see Section 3.5). Nevertheless, the cohort profiles share a few key patterns. First, the immigrants' profiles are generally concave, with low employment rates in the year of arrival but rapidly increasing employment over time. This typical assimilation profile (Borjas, 1995; Gathmann & Monscheuer, 2022) reflects the hurdles that migrants have to overcome, including barriers to formal labor market access, language acquisition and the imperfect translatability of skills and qualifications from their home countries. The observation that employment gaps close rapidly over the first 10 years after arrival for *all* groups is positive from a policy perspective. As we show below, the size of those initial gaps is nevertheless highly predictive of the size of immigrant-native gaps in the long run.

Second, most origin groups have substantially lower employment rates than natives of comparable age. The exceptions are migrants from North-West and Southern Europe (the former have *higher* employment rates) and Yugoslavian arrivals from the 1960s and 1970s (who reach employment rates above 90%). Other cohorts from Central and Eastern Europe, Yugoslavia during the Yugoslav wars and Asia (including Afghanistan, Pakistan and Vietnam) also do comparatively well, reaching employment rates around 80%. Migrants from Turkey do less well, in particular those arriving in the 1980s, for whom the employment rate remains 10-20 percentage points lower than for similarly-aged natives. Immigrants from the Middle East and Africa (1988-95 and 1996-05) have the lowest employment rates, reaching 70% ten year after arrival – a 20 percentage point gap to similarly aged natives.

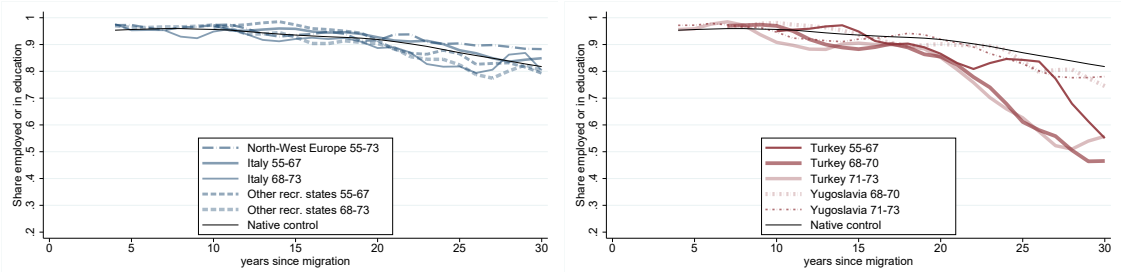
Third, the gaps never close fully for those groups who have low employment rates at arrival. While immigrants catch up rapidly over their first years, the gaps then stabilize for most groups. Then years after arrival, the mean gap across all immigrants is about 10 percentage points. For comparison, the employment gap in mid-life (age 35-50) between native men with and without a university degree has been around 6 percentage points throughout our analysis period. While previous researchers have hypothesized that immigrants in Germany assimilate fully in terms of wages (Gundel & Peters, 2008; Constant

[17] Specifically, it includes the self-employed, civil servants and military personnel as well as part-time, marginal and family employment. We additionally include persons in formal education (schools and universities), so that the initial gaps capture labor market disadvantages rather than differences in educational attainment at younger age. Our findings are otherwise robust to classifying persons in education as non-employed. We do not include training programs of the employment agency or language and integration courses for immigrants that do not lead to a general or vocational degree.

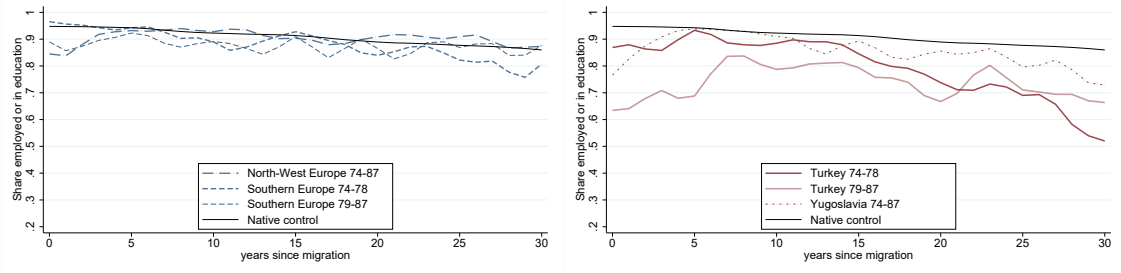
[18] The slight concavity of these employment profiles for counterfactual natives reflects the decline of employment rates at older ages.

FIGURE 3.2: EMPLOYMENT SHARES OF IMMIGRANT COHORTS

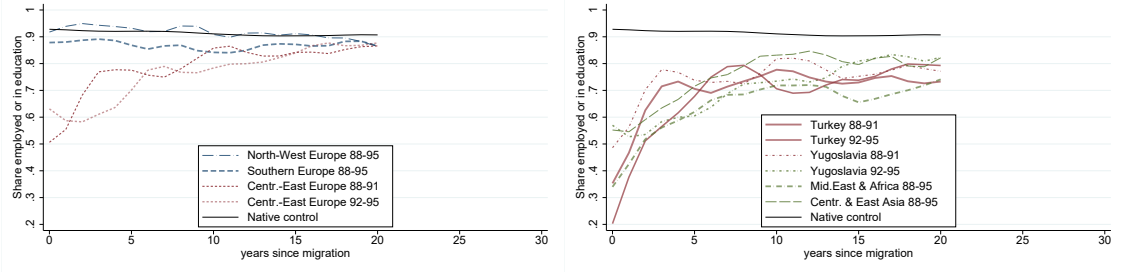
(A) ARRIVALS 1955-1973



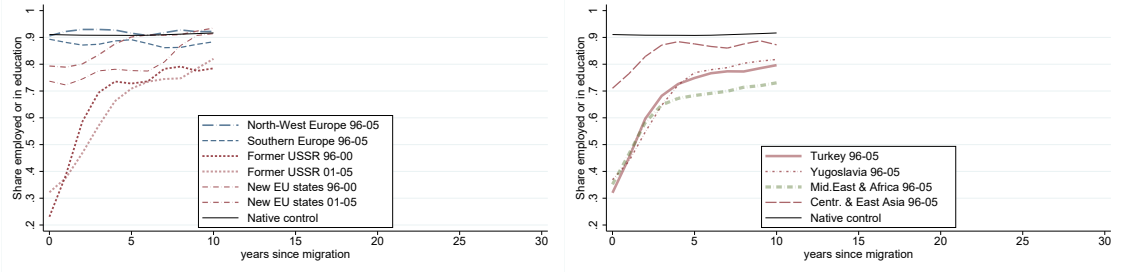
(B) ARRIVALS 1974-1987



(C) ARRIVALS 1988-1995



(D) ARRIVALS 1996-2005



Notes: Share in employment or formal education by year since migration, for different immigrant cohorts and a native control group (of the same age and observation year, see eq. (3.2). The thickness of each line is proportional to the cohort size in the first year after complete arrival.

& Massey, 2005; Fertig & Schurer, 2007), less attention has been put so far on the question whether immigrants fully catch up to natives in terms of employment. We find that initial gaps are not fully overcome, with one exception: immigrants from Central-Eastern Europe and the new EU member states catch up rapidly, nearly closing the gaps after 20 years, despite large initial gaps.

Fourth, the slope of the employment profiles differs for refugees and other migrants. Cohorts with low refugee shares assimilate quite quickly after arrival, but show little convergence – or even divergence – after about 7-8 years in Germany. In contrast, the integration process for refugee cohorts takes longer, with ongoing convergence even 10

years after arrival. As a result, refugee cohorts tend to catch up to other immigrants over time, as we show more explicitly below. These pattern also reflect differences in labor market access. While most migrants from European countries "migrate into" an employment contract, refugee migrants are often subject to employment bans upon arrival (see Figure 3.3c).[19]

Fifth, for some cohorts, the employment gaps started to worsen again after the initial convergence. This pattern is particularly pronounced for Turks who arrived up to the 1980s, for whom employment rates dropped massively – by up to 30 percentage points – in the early 1990s. This pattern can be considered an extreme example of the more general finding that immigrant employment is "fragile", in the sense of being more sensitive to economic conditions and shocks than the employment of natives (Bratsberg et al., 2010). We consider specific explanations in Section 3.7.1 and Chapter 4. The employment gaps remain more stable for more recent cohorts. However, these cohorts have not yet experienced a similarly strong economic downturn, or reached older ages. An important policy concern, also in light of the recent pandemic- and war-related downturns, is whether a similar collapse in employment rates could occur for the current immigrant population.

Conditional comparisons. So far, we focused on an unconditional comparison of migrants to similarly aged natives, without attempting to match their education or other characteristics, as our aim is to quantify the overall economic integration of migrants. Still, conditional comparisons can be indicative about the mechanisms that contribute to the unconditional immigrant-native gap in employment.

Figure 3.3 shows four types of conditional comparisons. Sub-figure (a) compares the unconditional immigrant-native gap as defined in equation (3.1) with a conditional gap that controls for education (interacted with observation year). The dark lines correspond to arrival cohorts 1974-95, which we can track over at least 20 years. The light lines include our full set of arrival cohorts 1974-2005, whom we can track over 10 years.[20] As expected, the lower education level among migrants explains part of their employment gap to natives. However, while explaining little of the employment gap in the first decade after arrival, the gap in education explains an increasingly larger share in later years. Indeed, 20 years after arrival, nearly half of the remaining employment gap can be explained by the lower educational attainment of immigrants.

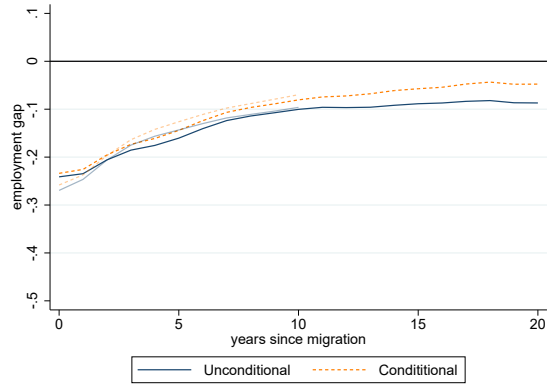
This pattern is illustrated further in Sub-figure (b), which plots the employment gap separately for immigrants without any secondary school or vocational degree (13.2% of immigrants vs. 3.2% of the native control group), with secondary school or vocational training (68.5% vs. 77.4%), and with a university degree (18.3% vs. 19.4%). Each group is compared to corresponding natives with the same education, age and observation year.

[19] As pointed out in Appendix 3.3c, refugees without an accepted asylum application face employment bans of varying duration. These employment bans may not only delay labor market integration, but also affect their long-term outcomes adversely. In particular, Fasani et al. (2021a) and Marbach et al. (2018) find that the exposure to temporary employment bans imposed by many European countries also reduces the employment probability of asylum seekers in the *post*-ban years.

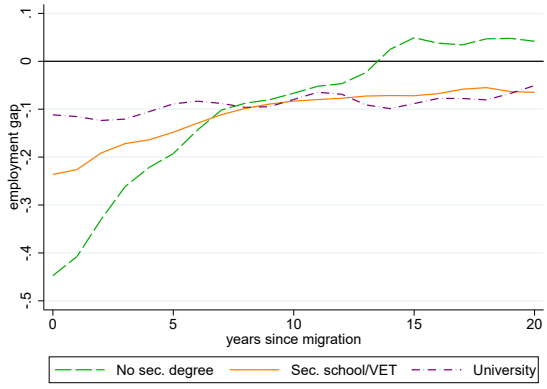
[20] Here, we exclude cohorts that arrived before 1974, because we can only observe them only starting in 1976 and have no data for the first years since arrival.

FIGURE 3.3: CONDITIONAL EMPLOYMENT GAPS

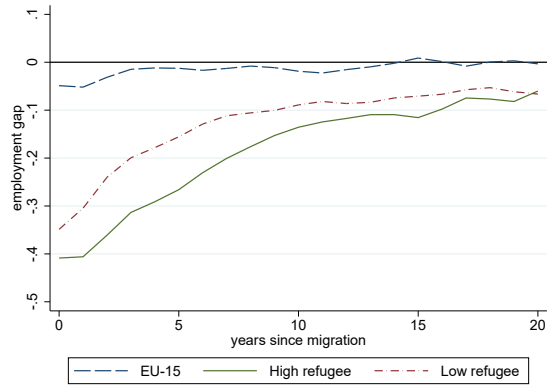
(A) CONDITIONAL VS. UNCONDITIONAL GAPS



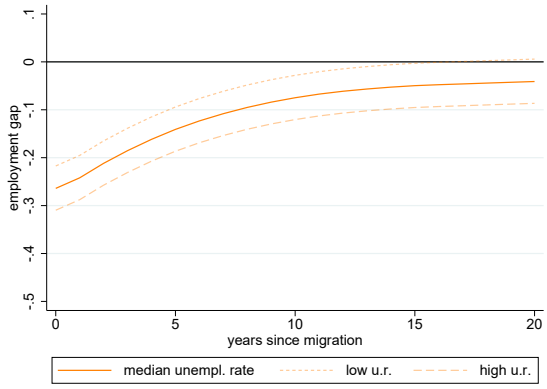
(B) CONDITIONAL GAPS BY EDUCATION



(C) CONDITIONAL GAPS BY COHORT TYPE



(D) CONDITIONAL GAPS BY REGIONAL UNEMPLOYMENT RATE



Notes: **Sub-figure (a):** Solid blue line: Unconditional immigrant-native gaps estimated non-parametrically according to eq. (3.1). Orange dotted line: additionally control for education group × year dummies. Dark lines include arrival cohorts 1974-95 (observable over 20 years since arrival), light lines include cohorts 1974-2005 (observable over 10 years). **Sub-figures (b) and (c):** Conditional gaps (non-parametric estimates) for different immigrant groups. **Sub-figure (d):** Conditional gaps, based on variants of eq. (3.3) and (3.4) including interactions between the regional unemployment rate (federal states) and dummies for immigrants and natives. Predicted gap at the median regional unemployment rate (7.9%, solid line), bottom decile (4.4%, dashed line) and top decile (11.8%, dotted lines).

We find that the lower the education of immigrants, the larger the initial employment gaps and the stronger the catch-up over time. After about 10 years, the employment gaps are similar for those with a university education or a vocational/secondary school degree, while immigrants without educational degree overtake their native counterparts (perhaps reflecting that the latter are a particularly small and selective group).

Sub-figure (c) compares the employment profiles of three types of cohorts: Predominantly from EU-15 countries[21], from other countries with less than 50% refugees, and from other countries with at least 50% refugees. Consistent with Figure 3.2, we observe that EU-15 arrivals have small initial gaps and catch up quickly (within 3-4 years) to their similarly-aged native counterparts. In contrast, the employment gaps remain substantial for non-EU migrants, even conditional on education. Interestingly, the gap between

[21] including cohorts from North-West and Southern Europe, including Italy and "other recruitment states"

non-EU cohorts with low vs. high share of refugees shrinks throughout, and becomes negligible after two decades. This finding is in line with Fasani et al. (2021b); Marbach et al. (2018) who find that the integration process tends to be much more long-lasting for refugees than for non-refugees.

Finally, Sub-figure (d) of Figure 3.3 illustrates that the size of the employment gap varies with economic conditions. Following the literature (Barth et al., 2004), we include the current regional unemployment rate interacted with a migrant dummy and educational attainment interacted with time dummies into a parametric estimation based on equation (3.5). The predicted employment gap is plotted at the median regional unemployment rate (7.9%, solid line), at the 10th percentile (4.4%, dotted line) and the 90th percentile (11.8%, dashed line). Regional unemployment conditions have a strong association with integration trajectories: 10 years after migration, the immigrant-native gap in regions at the 10th percentile of unemployment has closed (conditional on education) but remains close to 10 percentage points in regions at the 90th percentile.

3.4.2 Results: Income

Unconditional comparisons. Figure 3.4 plots the integration profiles for individual post-tax income.[22] The patterns are similar when considering log income (Figure 3.A6).

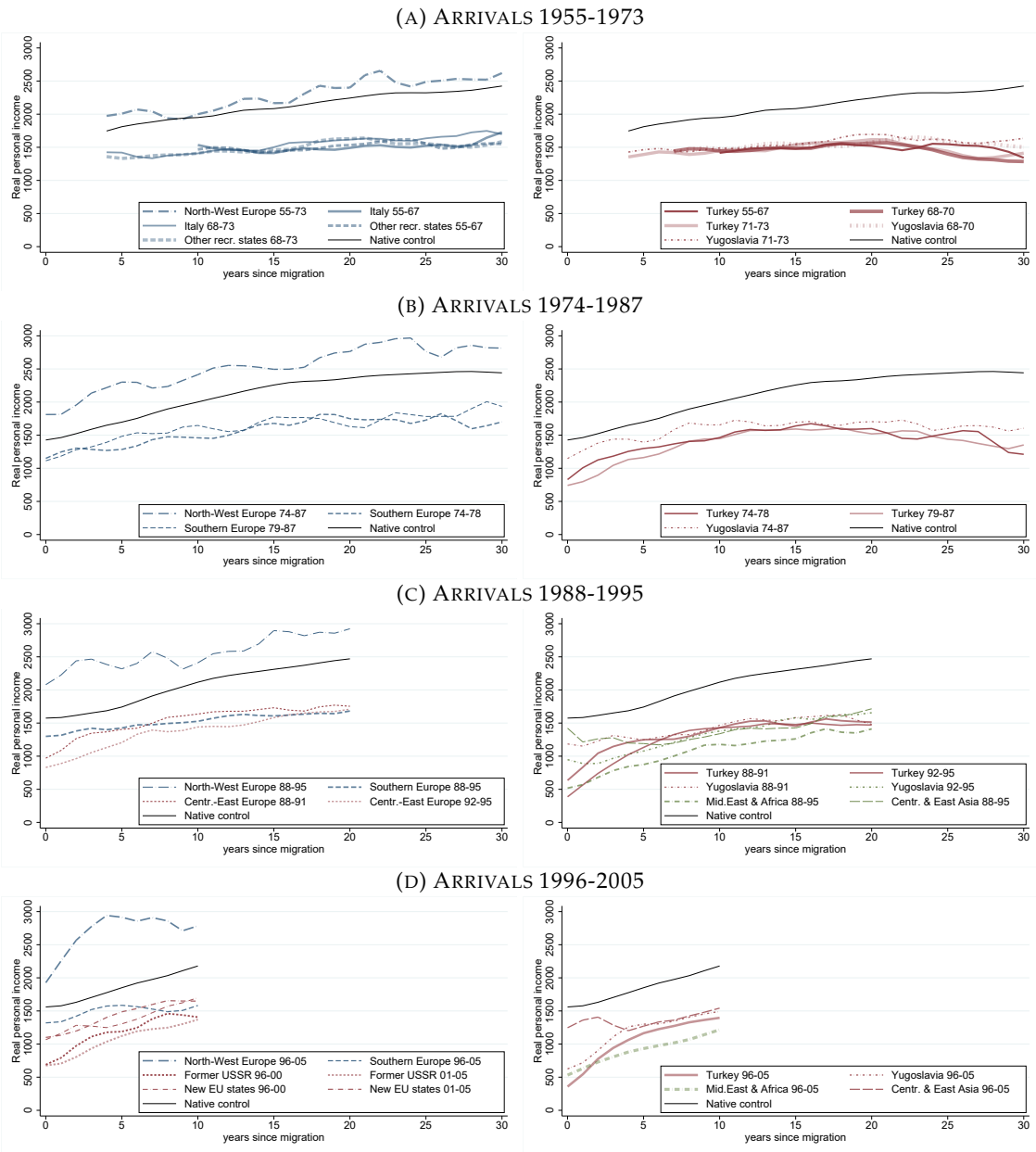
A first interesting pattern is how stable the income pattern of different origin groups have been over the past 50 years. In particular, the income trajectories of Southern Europeans have changed surprisingly little since the so-called "guest worker" period: 10 years after arrival, their average income reaches around 1,500 Euros in real terms, with only moderate income growth over time. Turkish and Central-Eastern European cohorts arriving after the recruitment period start with larger initial gaps (average income below 1,000 Euros) but experience faster growth, so that they eventually catch up to Southern-Europeans.[23] Groups with a high share of refugees receive particularly low incomes and show relatively slow, but steady income growth, in particular those from the Middle East and Africa. Asian groups show similar patterns, but on a substantially higher level. Finally, immigrants from North-Western Europe increasingly outperform natives, with their income gap rising from a few percents in the 1955-73 arrival cohort to a 20-30% gap for the 1996-2005 cohort.

Although income tends to increase with more time spent in Germany, the income of the similarly aged natives increases at a similar or higher pace (with migrants from North-West Europe being the exception). More specifically, the immigrant-native income gap tends to be stable or decrease for a few years after arrival, but then widens considerably. Twenty years after arrival, the average income gap between migrants and natives

[22] Average incomes increase less than one might expect over the long time period studied. We identify several reasons for this pattern: First, unemployment rates have grown from close to zero in the 1970s to 12% around the year 2000 and average weekly working hours conditional on employment have dropped from 37.7 to 33.3 between 1976 and 2015. Both trends mask an increase in hourly wages of more than 30%. Additionally, we focus on working age males and therefore ignore the increase in female labor supply that strongly contributed to an increase in average per-capita household income of more than 40%.

[23] The large initial income gaps for Turkish immigrants reflect this groups' tendency to rely on support from family or friends as opposed to welfare in the first years after arrival.

FIGURE 3.4: MEAN INCOME OF IMMIGRANT COHORTS



Notes: Mean real personal post-tax income (in 2010 Euro) by year since migration, for different immigrant cohorts and a native control group (of the same age and observation year, see eq. (3.2). The thickness of each line is proportional to the cohort size in the first year after complete arrival.

has grown to 1,000 Euro/month in the 1974-87 cohort, and similar or more pronounced gaps are visible for later arrival cohorts. This lack of convergence, and even divergence for most groups, may appear at odds with previous studies that found wage assimilation (Gundel & Peters, 2008; Constant & Massey, 2005; Fertig & Schurer, 2007; Lehmer & Ludsteck, 2015; Gathmann & Monscheuer, 2022). However, these studies differ in two important aspects from our work. First, they evaluate the wage profiles of *employed* immigrants, which reflect selection into employment (Gathmann & Monscheuer 2022). We instead consider all immigrants independent of their employment status, and include non-labor earnings. Second, most other studies control for individual characteristics,

such as education. In contrast, we focus on unconditional comparisons between immigrants and natives, holding only their age and observation year fixed. However, the lower education of immigrants cannot fully explain the divergence of income profiles, as we show below.

Surprisingly, the integration profiles vary much less across cohorts for income than for employment. In employment, we see major differences between groups; for example, after one decade the employment rate of Turkish 1979-87 arrivals is more then 15 percentage points below the corresponding rate for natives, while there is essentially no gap for the 1974-87 arrivals from Yugoslavia. However, both groups earn substantially less than similarly-aged natives. Indeed, according to Figure 3.4, the mean (monthly) income stabilizes at around 1,500 Euro (1955-73 cohorts) or slightly higher (later cohorts) for all origins, with North-Western Europeans as the only exception. That the income profiles vary so little across groups is puzzling, given that their educational and employment levels do differ widely. Moreover, the steadily increasing income gaps shown in Figure 3.4 stand in contrast to the corresponding time pattern for employment, for which we observe rapidly decreasing gaps within the first years after arrival.[24]

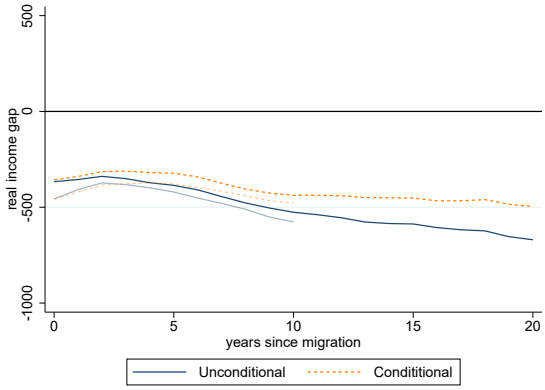
Conditional comparisons. Figure 3.5 summarizes this evidence and reports four different conditional comparisons. Sub-figure (a) compares the unconditional income gap between immigrants and similarly-aged natives with the corresponding gap conditional on education. The pattern are similar for earlier cohorts (1974-95, dark lines) that we can track over their initial 20 years and and their initial 10 years in Germany (1974-2005, light lines).[25] Education cannot explain the initial immigrant-native gaps, but explains some of the widening of those gaps over time. Still, the income gaps also tend to widen conditional on education. This finding can be explained by immigrants working in segmented labor markets with unfavorable career opportunities Doeringer & Piore (1971). As illustrated in Sub-figure (b) of Figure 3.5, this pattern is driven by the large share (68.5%) of immigrants with secondary school or vocational training. The absolute gaps are instead highest for university-educated immigrants, after widening substantially over the first decade after arrival (from 600 Euro to about 900 Euro per month), before closing partially in later career stages. This observation is in line with the "downgrading" literature (Eckstein & Weiss, 2004), which suggests that high-skilled immigrants are strongly affected by the depreciation of country-specific human capital.

Sub-figure (c) illustrates that the income gaps are largest for non-EU migrants. As for employment, we observe that the integration process takes longer for cohorts with a high share of refugees, but the income gaps are in fact similar for low- and high-refugee cohorts in the long run. Finally, Sub-figure (d) demonstrates that income gaps vary surprisingly little with local economic conditions. Based on variants of equations (3.3) and

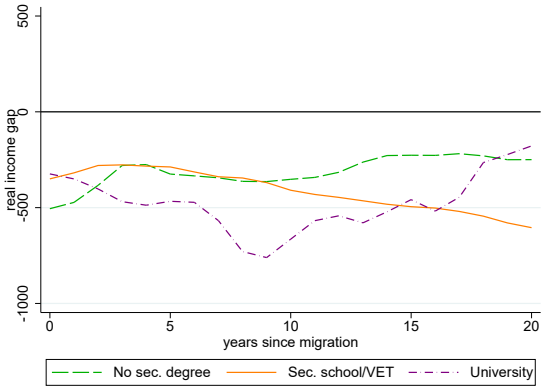
[24] One potential explanation is that immigrant's income may not improve much when finding their first job, with welfare payments being crowded out by labor earnings. However, immigrants who recently found a job do have considerably higher income than those who did not. Instead, the main explanation for divergence in income is that, compared to natives, migrants have lower earnings growth conditional on being employed.
[25] We exclude the "guest-worker" cohorts here because we cannot observe their initial years in Germany.

FIGURE 3.5: CONDITIONAL GAPS IN INCOME

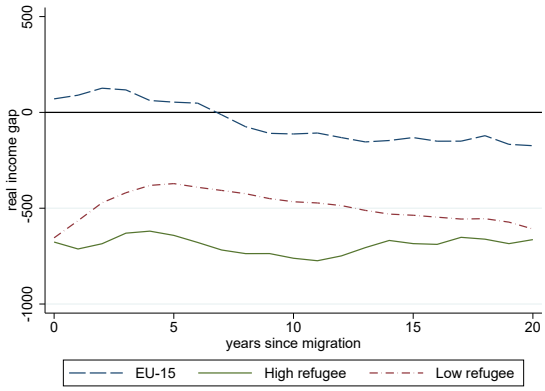
(A) CONDITIONAL AND UNCONDITIONAL INCOME GAPS



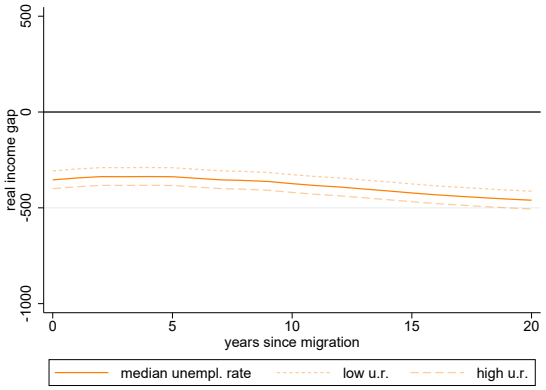
(B) CONDITIONAL GAPS BY EDUCATION GROUPS



(C) CONDITIONAL GAPS BY COHORT TYPE



(D) CONDITIONAL GAPS BY REGIONAL UNEMPLOYMENT



Notes: **Sub-figure (a):** Blue solid line: Unconditional immigrant-native gaps in real personal post-tax income, estimated non-parametrically according to eq. (3.1). Orange dotted line additionally control for education group × year dummies. Dark lines include arrival cohorts 1974-95 (observable over 20 years since arrival), light lines include cohorts 1974-2005 (observable over 10 years). **Sub-figures (b) and (c):** Conditional gaps (non-parametric estimates) by different immigrant groups. **Sub-figure (d):** Conditional gaps, based on variants of eq. (3.3) and (3.4) including interactions between the regional unemployment rate (federal states) and an dummies for immigrants and natives. Predicted gap at the median regional unemployment rate (7.9%, solid line), bottom decile (4.4%, dashed line) and top decile (11.8%, dotted lines).

(3.4) that include the regional unemployment rate (interacted with an immigrant indicator and years since migration), we plot the predicted income gap at the median regional unemployment rate (7.9%, solid line) and the 10th and 90th percentiles (4.4% and 11.8%, dotted and dashed lines). We therefore find that economic conditions have a large effect on the immigrant-native gaps in employment (Figure 3.3(d)), but their effect on the corresponding gaps in income is smaller (the difference in the monthly income gap between the 10th and 90th percentile is just 100€).[26]

What is the (policy) relevance of these findings? The good news is that in *absolute* terms, the economic situation of immigrants improves considerably with more time spent

[26] One likely explanation is that the marginal immigrants who lose their jobs during economic downturns are negatively selected, in the sense of their earnings being only moderately higher than the benefits that they receive in unemployment.

in Germany. However, the gaps in employment are often large, and the *relative* income gaps compared to natives of similar age do in fact widen in most cases. Immigrants tend to have worse career opportunities compared to natives over their entire lifecycle, even when being employed, a finding that is discouraging from a distributional perspective. Another important finding is regarding the role of education in the integration process. On the one hand, differences in education can explain some of the employment gap between immigrants and natives. This suggests that educational policies – which can be directly affected by policymakers – might have a direct effect on the employability of immigrants. On the other hand, the immigrant-native gap in income remains high even conditional on education, and is in fact highest among the university-educated. Educational policies alone might therefore have only a limited effect on the economic standing of immigrants in Germany.

3.4.3 Other Outcomes

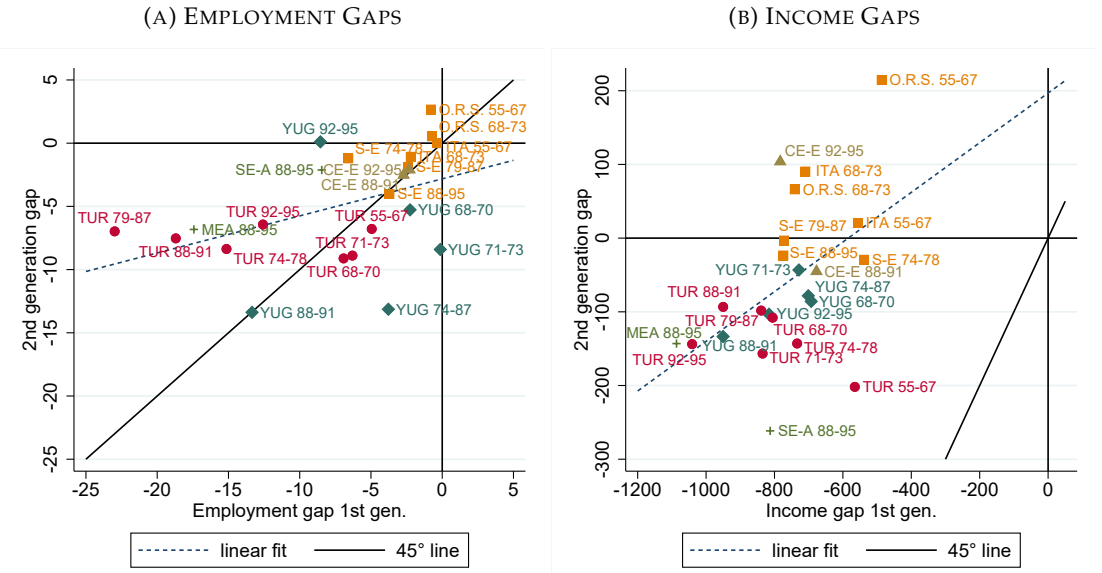
As auxiliary outcomes we also track welfare dependency (to measure the direct costs of immigration) and intermarriage rates (as an indicator for social segregation, which may interact with economic segmentation). The results are shown in Appendix Figure 3.A4 and Table 3.A2 and discussed in Appendix 3.A.3. Immigrants are more likely to be dependent on welfare benefits as their main source of income compared to the native comparison group, with the pattern across cohorts mirroring our results on employment. In terms of marriage pattern, the differences between origin groups are striking: immigrants from the traditional "guest worker" countries married nearly exclusively within their own ethnic communities, while the intermarriage rates vary more considerably for more recent immigrant groups.

3.4.4 Second-Generation Immigrants

Do these employment and income gaps persist for the second generation? US studies generally find that the wages of first-generation immigrants do not fully catch up to natives, but that the wage gap closes for their children (Card, 2005). Thus, full assimilation might take more than one generation. To identify second-generation immigrants reliably, we exploit that in the years 2005, 2009 and 2013, the microcensus includes a supplementary questionnaire on the migration background of parents living outside the household. To be consistent with the rest of our study, we define second-generation immigrants as working-age males born in or migrated to Germany at age 6 or younger, whose fathers migrated to Germany (including naturalized fathers, but excluding ethnic Germans). The definition is thus independent of the mother's nationality or migration status.

Figures 3.6a and 3.6b plot the employment and income gaps of first generation migrants (measured 20 years after migration) against the second generation gaps (measured in 2005, 2009 and 2013). We focus on 20 years since migration for the first generation because we do not want to capture the initial convergence after arrival. Recall that the immigrant-native gaps as defined in equation (3.1) condition on age and observation

FIGURE 3.6: LABOR MARKET GAPS FOR FIRST AND SECOND GENERATION IMMIGRANTS



Notes: Unconditional immigrant-native gaps estimated non-parametrically according to eq. 3.2. First-generation gaps measured 20 years after migration to Germany. Second-generation gaps measured in 2005, 2009 and 2013. The labels refer to region of origin (See Table 3.A1) and arrival year: CE-E: Central and Eastern Europe; ITA: Italy; MEA: Middle East and Africa; O.R.S: Other recruitment states; CE-A: Central and East Asia; S-E: Southern Europe; TUR: Turkey; YUG: (former) Yugoslavia. We drop second-generation immigrants from North-Western Europe because of low observation numbers and drop cohorts that arrived after 1995, as their children have not yet reached working age by the time of observation.

year, which partly addresses the fact that children of more recent cohorts are observed at younger ages than children of older cohorts.[27]

A few observations stand out: First, the employment and income gaps generally shrink between the first and second generation. For employment, the average gap shrinks from 7.1 percentage points in the first to 4.9 percentage points in the second generation (i.e., by about 30%). The income gains are particularly impressive: for most cohorts, the income gaps ranged between 400 and 800 Euros for the first generation, but shrink to 100-200 Euros for the second generation. Second, the labor market gaps are correlated across generations: The children of groups with favorable labor market performance tend to be successful as well, while integration difficulties are passed on to the next generation. Third, there are clear clusters by regions of origins: Southern European cohorts (green squares) and Eastern Europeans (brown triangles) had small employment and large income gaps in the first generation, but catch up fully to natives in the second generation. The employment gaps of Turkish and Yugoslav cohorts instead remain large, between 5-10 percentage points, although they experience large income gains across generations. Turkish and Yugoslav guest worker cohorts who arrived before the mid-1970s even experience a widening of employment gaps across generations. Fourth, while the first-generation employment gaps varied strongly by arrival year within group (e.g., between

[27] Even when additionally residualizing all age variation in the second-generation immigrant-native *gaps*, the overall patterns and slopes of the linear fit change only marginally.

5 and 23 percentage points for Turkish cohorts), the second-generation gaps tend to be more uniform (5-10 pp.). Diehl & Granato (2018) argues that differences in education and language proficiency explain why second-generation gaps are largest for Turks and Yugoslavs. These findings resemble evidence from the US (Cadena et al., 2015), where wage gaps on average shrink by roughly 70% between the first and second generation, but do not disappear completely for all migrant groups: Similarly to the Turks and Yugoslavs in Germany, wage gaps for second generation Hispanic and black migrants remain substantial.

From a policy perspective, the large improvements for the second generation are good news, suggesting that immigrant groups will tend to catch up to natives eventually. However, the employment gaps are particularly persistent for exactly those groups that already struggled most to begin with, such that integration outcomes are polarizing across generations. These results extend on findings by Algan et al. (2010), who find that the evidence for labor market progress is not so clear-cut in Germany. While we confirm their finding that the employment gaps tend to worsen for second-generation Turkish immigrants, we find a more positive pattern for other groups, such as Southern Europeans.[28]

3.5 How Predictable Are Integration Outcomes?

Labor market outcomes vary substantially across groups: while some cohorts catch up with natives, for others the employment gap remains as large as 20 percentage points. One key question is how predictable those gaps are – is it possible to predict which cohorts will or will not integrate well into the labor market, based on information that is observable at arrival? We here show that this is indeed the case: most differences can be explained by a small set of characteristics that are readily available to policymakers.

A first interesting question is whether *individual* or *group-level* characteristics, i.e. the average characteristics of a "cohort" defined by arrival period and origin, are more predictive of labor market success. If the aim is to predict individual outcomes, the answer may appear obvious – a person's own education should be more predictive for that person's success than the average attainment of the group he happens to belong to. But as shown in Appendix 3.A.4, that is not generally the case, and cohort-level characteristics are important predictors even conditional on the persons' own characteristics.

We therefore focus on the explanatory power of summary statistics on the *group* level. Specifically, Table 3.2 reports the coefficient estimates from a regression of the unconditional labor market gaps $\hat{y}_i^{gap}$ defined in equation (3.1), and averaged for each of the 36

[28] Our analysis differs from this previous research in two important ways: Firstly, we consider not only wages, but also non-labor earnings (including welfare benefits). Secondly, we do not rely on a single cross-section in which first and second generations are necessarily observed at very different ages, but pool many waves of the microcensus.

TABLE 3.2: EXPLAINING COHORT-LEVEL LABOR MARKET GAPS

	Employment gaps (p.p.)			Income gaps (Euro)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A): Initial gaps						
Share with sec. school degree	10.26***		-1.45	185.20***		-59.91
	(1.81)		(2.76)	(45.11)		(65.29)
Share w. university degree	-5.83**		1.05	157.99*		243.70***
	(2.85)		(3.34)	(79.44)		(82.28)
Refugee share		-12.03***	-4.30**		-85.67***	-62.36
		(2.77)	(1.72)		(29.31)	(101.53)
EU-15 (dummy)		2.59	6.04**		278.91***	203.69***
		(1.56)	(2.49)		(64.46)	(57.58)
Unemployment rate			-10.65***			-198.68***
			(2.46)			(54.61)
Number of cohorts	36	36	36	36	36	36
Adj. R^2	0.41	0.57	0.76	0.40	0.65	0.78
Panel (B): Gaps 10 years after arrival						
Share with sec. school degree	4.88***		0.87	203.15***		13.05
	(0.94)		(1.10)	(48.22)		(68.77)
Share w. university degree	-1.37		2.28**	114.24		217.61**
	(0.88)		(1.07)	(74.69)		(105.81)
Refugee share		-5.21***	-1.76**		-109.19***	-78.73
		(1.03)	(0.66)		(26.71)	(132.55)
EU-15 (dummy)		0.33	0.67		195.86**	103.34
		(0.82)	(0.72)		(78.75)	(75.02)
Unemployment rate			-2.20*			-151.32**
			(1.19)			(63.36)
Number of cohorts	36	36	36	36	36	36
Adj. R^2	0.55	0.56	0.83	0.49	0.56	0.72
Panel (C): Explaining 10-year gaps with initial gaps						
Initial gap			6.29***			314.41***
			(0.60)			(30.97)
Number of cohorts			36			36
Adj. R^2			0.79			0.86

Notes: Dependent variable: Cohort-level employment gaps in percentage points (columns 1-3) or real individual post-tax income in 2010 Euros (columns 4-6) according to equation (3.1). Explanatory variables are measured upon arrival and standardized (mean=0, standard deviation=1). We report small sample robust standard errors (Davidson, MacKinnon & others, 1993). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

cohorts, on different sets of cohort characteristics.[29] In panel (A) we consider the *initial* gaps upon arrival. Columns (1) and (4) show that about 40% (adjusted R-squared) of

[29] For cohorts that arrived before 1974 we cannot observe employment and income at arrival and instead take values from the earliest available census wave in 1976. The results change only marginally if we exclude these early waves from our analysis. We report standard errors that are robust to small samples in these tables (STATA's vce(h3) option, based on Davidson et al. 1993), but conventional standard errors are similar.

the variation in the initial employment and income gaps can be explained by the average education of each cohort (the share with secondary school or vocational degree, and the share with a university degree). As shown in columns (2) and (5), the cohort shares of refugees and a dummy for EU-15 origins (see Section 3.3.3) are even more predictive, explaining 57% of the variation in employment and 65% of the variation in income gaps upon arrival. While the gaps are mostly explained by characteristics of the origin groups themselves, economic conditions do matter. As shown in columns (3) and (6), the employment or income *gaps* to similarly aged natives are greater when the (standardized) average unemployment rate at arrival is higher, although this association also reflects general trends in integration outcomes over time (see Section 3.6).

Panel (B) of Table 3.2 shows estimation results for the corresponding gaps 10 years after arrival. The cohort composition remains a strong predictor of immigrant-native gaps, but the relative importance of different characteristics changes: educational gaps at arrival become an increasingly stronger predictor of labor market gaps over time, while the explanatory power of refugee status decreases slightly. The explanation for the latter is that refugee arrivals are less likely to have immediate access to the labor market, but tend to slowly catch up relative to non-refugees over the following decades (see Figures 3.2c and 3.4c). Considering the unemployment rate at arrival in columns (3) and (6), we again find coefficients of the expected sign: employment and income gaps are more negative for cohorts that arrived in times of high unemployment. However, economic conditions explain a much smaller share of these gaps than cohort characteristics, and are imprecisely estimated. Overall, we can explain 83% of the variation in employment and 72% of the variation in income with simple summary statistics for each immigrant group.

Cohort characteristics at arrival therefore explain the 10-year gaps as well as they explain initial gaps – while immigrants catch up with natives, the differences between immigrant groups remain predictable. Indeed, long-run integration outcomes can be also predicted based on the initial gaps. As shown in panel (C) of Table 3.2, the initial employment gaps explain 79% of the employment gaps one decade later (column 3), and the corresponding R-squared is even higher for income (column 6).

Overall, we find that integration outcomes are highly predictable: historically, basic summary statistics on the composition of each origin group or their initial labor market performance have been very predictive of how well those groups integrate into the German labor market.[30] This also suggests that most of heterogeneity in integration profiles documented in Section 3.4 is due to differences in the characteristics of those groups rather than differences in the circumstances they faced at arrival, although macroeconomic conditions do matter (see Section 3.7.1). We illustrate the potential use of these results in Section 3.7.2, by predicting the likely integration paths of (i) the large refugee cohort that arrived to Germany around 2015 and (ii) the most recent group of refugees who fled the war in Ukraine since 2022.

[30] To show that these results are robust to specification, we repeat this analysis for finer cells of arrival "cohorts", namely origin group × arrival period × education × age at migration cells. The results are similar and available upon request.

3.6 Has Integration Improved over Time?

Has the labor market integration of immigrants structurally improved over the past 50 years? As other European countries, Germany has become exposed to immigration much later than the US, and Dustmann & Frattini (2013) note that this lack of experience of institutions and societies may be one of the factors hindering successful integration. Following this argument, we might expect the institutional setting and thus integration outcomes to improve over time.

A visual inspection of Figures 3.2 and 3.4 however suggests that in Germany, the *initial* employment and income gaps have grown larger for recent cohorts. Multiple factors might explain this pattern: On the one hand, the composition of cohorts has changed, with increasing shares of refugees who tend to require more time to gain a foothold in the labor market than other migrants.[31] On the other hand, Germany's immigration policy today is placing a greater emphasis on integration measures and language acquisition, which could improve long-run integration prospects but reduce employment in the first years after arrival. General labor market conditions, such as the high unemployment in the late 1990s and early 2000s, might also affect integration patterns.

To better understand those trends, Table 3.3 therefore reports linear time trends from the regression

$$\hat{y}_i^{gap} = \alpha + \rho Year_t + \phi X_{i,c(i)} + \theta UR_{r(i),t} + \varepsilon_i$$

where $\hat{y}_i^{gap}$ is the predicted labor market gap as defined in equation (3.1) for immigrant i from cohort c in region of residence r, observed 10 years after arrival in year t, $Year_t$ represents a linear time trend, $X_{i,c(i)}$ a vector of controls that – depending on the specification – include dummies for individual school degree and university degree and the refugee share of each cohort, and $UR_{r(i),t}$ is the regional unemployment rate in year t.

Panel (A) confirms that the initial employment gaps have widened over time, by about 5 percentage points for each decade (column 1, $\hat{\rho}/10 = -5.1$) – corresponding to an enormous increase of 25 percentage points over 50 years. This increase cannot be explained by changing educational composition; indeed, the time trends are *more* negative conditional on the educational composition of different immigrant cohorts (column 2). This observation is in line with previous findings by Kogan (2011), who emphasizes that the cohorts that arrived since the 1990s were not able to translate their higher levels of formal education into better employment prospects compared to the earlier groups of "guest workers" and their families. The remaining gap is highly correlated with refugee shares and changing labor market conditions over time; indeed, when additionally controlling for refugee share and regional unemployment $\hat{\rho}$ becomes insignificant and close to zero (column 4).[32] The results are similar when studying conditional gaps, i.e. gaps

[31] Moreover, Basilio et al. (2017) and Constant & Massey (2005) argue that for recent immigrant groups, poor transferability of foreign human capital has slowed down job mobility. The educational expansion among Germans and increasing returns to education might have also contributed to a widening of socio-economic gaps (Kalter & Granato, 2002; Gundel & Peters, 2008).

[32] The results remain similar when using national rather than regional unemployment rates, or when controlling for region of origin dummies instead of refugee shares (as the two are highly correlated).

TABLE 3.3: TIME-TRENDS IN IMMIGRANTS' LABOR MARKET GAPS

	(1)	(2)	(3)	(4)
Panel (A): Employment gaps at arrival (p.p.)				
Time trend (10 years)	-5.07*	-5.89**	-2.05	0.93
	(2.77)	(2.51)	(2.23)	(1.98)
Observations	20,613	20,613	20,613	20,613
Panel (B): Employment gaps 10 year since arrival (p.p.)				
Time trend (10 years)	-3.27***	-3.76***	-1.86***	-0.57
	(0.64)	(0.56)	(0.53)	(0.52)
Observations	21,296	21,296	21,296	21,296
Panel (C): Income gaps at arrival (Euros)				
Time trend (10 years)	-104.44	-152.76**	-70.21	-27.78
	(97.82)	(71.38)	(74.05)	(78.15)
Observations	19,776	19,776	19,776	19,776
Panel (D): Income gaps 10 year since arrival (Euros)				
Time trend (10 years)	-60.97	-110.90***	-35.49	-16.03
	(37.03)	(26.47)	(35.80)	(40.42)
Observations	20,632	20,632	20,632	20,632
Education contr.	No	Yes	Yes	Yes
Refugee share	No	No	Yes	Yes
Regional unempl. rate	No	No	No	Yes

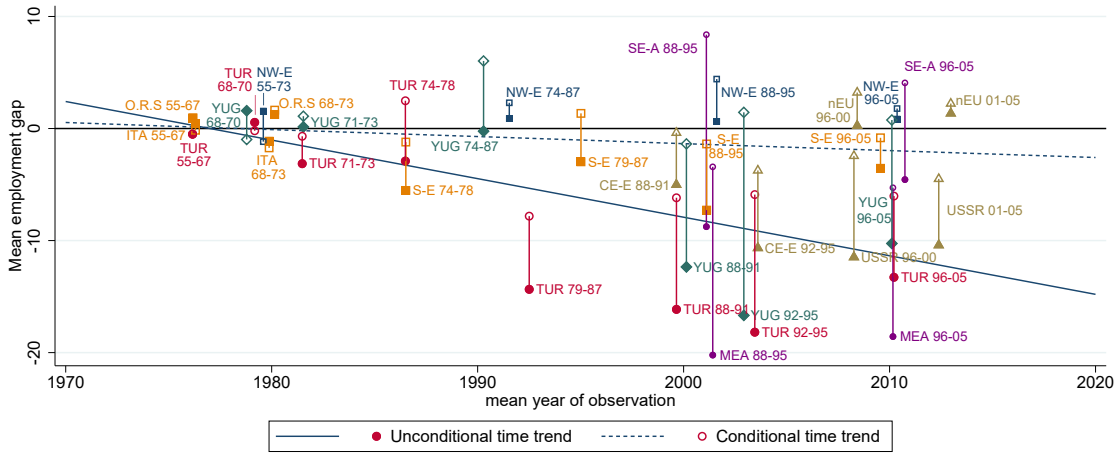
Notes: The dependent variables are individual migrant-native employment gaps (including education) predicted according to equation (3.1). The variable that captures the linear time trend is year/10, thus coefficients capture a change over one decade. Educational controls are individual dummies for an academic degree and a vocational degree, refugee share is measured on the cohort level, regional unemployment rate on the individual level. Standard errors clustered on the level of cohorts in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

that compare the difference between immigrants and natives not only of the same age and observation year, but also of the same education.

Panel (B) shows that the employment gaps 10 years after arrival have also widened substantially (column 1, $\hat{\rho}/10 = -3.3$), although less in absolute levels – as is expected, given that the employment gaps generally shrink with time after arrival. Its statistical significance however is much higher, suggesting a clear worsening of immigrant-native gaps over time. The high refugee share of recent arrival cohorts explain a small part of this pattern (column 3), while additionally controlling for the regional unemployment rate dampens the time trend further (column 4). Figure 3.7 provides more details on these results, visualizing time trends net of control variables and level-differences in employment gaps. The solid markers and line correspond to the unconditional employment trends 10 year after arrival, corresponding to column (1), while the hollow markers and dashed line correspond to the conditional trend as reported in column (4) of Table 3.3, panel (B).

Income gaps as reported in panels (C) and (D) of Table 3.3 have also been widening over the past 50 years. When controlling for education (column 2), these time trends become more negative and statistically significant, both at arrival and after 10 years: Every

FIGURE 3.7: TIME TRENDS IN IMMIGRANT-NATIVE EMPLOYMENT GAPS (10 YEARS SINCE ARRIVAL)



Notes: Filled markers and solid line: unconditional time trend in immigrant-native employment gaps; Hollow markers and dashed line: conditional time trend. Time trends are measured as the predicted time trend plus the residuals from regressions in panel (B) of Table 3.3 and aggregated to the cohort level. Unconditional time trends refer to column (1) and conditional time trends to column (4), including controls for individual education, regional unemployment rate and cohort-level refugee share. For estimation, the year 1976 is rescaled to $year = 0$ (The first microcensus wave used in this study). The labels refer to region of origin (See Appendix Table 3.A1) and arrival year: CE-E: Central and Eastern Europe; ITA: Italy; MEA: Middle East and Africa; nEU: New EU member states; O.R.S: Other recruitment states; CE-A: Central and East Asia; S-E: Southern Europe; TUR: Turkey; YUG: (former) Yugoslavia.

decade, the immigrant-native gap in income 10 years after arrival has widened by about 110 Euros, amounting to 550 Euros over 50 years. See also Appendix Figure 3.A7, which provides a graphical illustration of income trends over the past 50 years.

To summarize, the unconditional labor market gaps between immigrants and natives have increased considerable over time, as is also in line with findings by Sprengholz et al. (2021). Much of this negative time trend can be explained by changing cohort composition and economic conditions: accounting for these factors, the labor market prospects of immigrants have remained fairly stagnant (with employment gaps shrinking but income gaps increasing slightly). We do not find support for the hypothesis that structural integration conditions have improved as a consequence of new policy approaches that acknowledge Germany's role as an immigration country more explicitly. One possible explanation for this puzzle has been identified by Kogan (2016): Germany ranks highly in terms of providing and enabling access to general and targeted integration support, but in practice, there is a large discrepancy between policy intentions and the actual uptake of these policies. In 2008 less than 5% of recently arrived immigrants had actually participated in training programs and about 10% in job search assistance, much less than in many other European countries.

3.7 Case Studies

To end the paper, we present two case studies. First, we provide a deeper analysis of what we consider the most striking observation in the integration profiles depicted in Figure 3.2: the sudden collapse of employment among Turkish and some other groups in the early 1990s, after two decades of high attachment to the German labor market. Second, we study and forecast the employment profiles of the most important recent immigrant arrivals: the large cohort of refugees that arrived around 2015 and a more recent refugee wave who fled the 2022 war in Ukraine.

3.7.1 The 1990s Employment Collapse

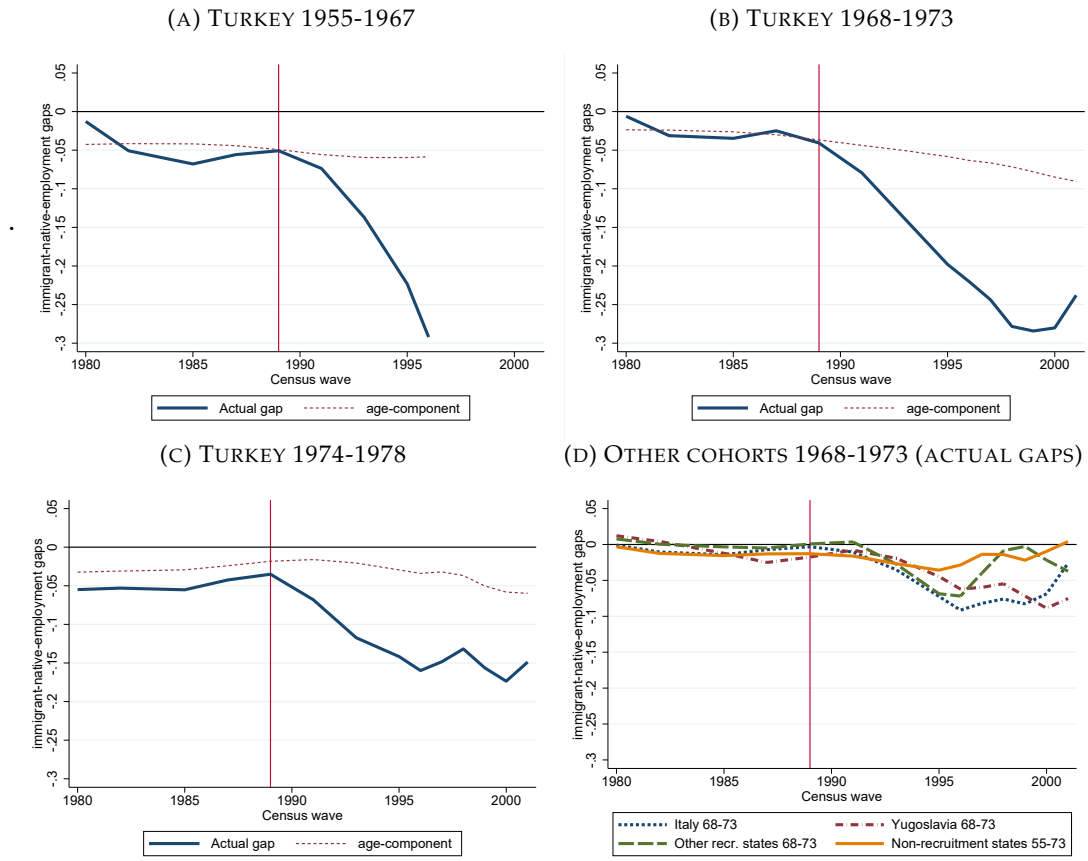
After a long spell of high employment, the employment rate of Turkish 1955-73 arrival cohorts collapsed by nearly *30 percentage points* in the early 1990s (relative to natives, and even more in absolute level).[33] The implication is that integration is not a one-way street: policy makers have to worry not only about the successful labor market integration of new immigrant arrivals, but also the potential for sudden evaporation of those gains in later years.

Our goal here is to identify potential explanations for this sudden collapse (for a more in-depth analysis, see Chapter 4). In a first step, we analyze whether the drop in employment is due to *time effects* (e.g., caused by sudden political or economic events around the fall of the iron curtain) or *age effects* (e.g., reflecting a difference in retirement behavior of immigrants relative to natives). In Figure 3.8 we compare, separately for Turkish cohorts who arrived between 1955-67, 1968-73 and 1974-78, the actual drop in employment with the drop that can be explained by the increasing age of those cohorts. Although the trend in the age component is slightly negative (the employment gaps between immigrants and natives widen at older ages, dashed line), the employment drop is nearly entirely explained by time effects: For each cohort, the employment rate starts to drop around 1990, and continues to drop in subsequent years. Sub-figure 3.8d shows that other immigrant groups were less affected, although the employment gaps are also widening for migrants from Southern Europe and Yugoslavia.

The explanation for the collapsing employment shares must therefore be an event or structural change that occurred in the early 1990s. Indeed, the West-German labor market was subject to several important shocks at that time: First, a recession in 1993 and high levels of unemployment over the following years. More generally, the 1990s were characterized by increasing automation and structural adjustments, and a strong decline in (mainly low-skilled) manual work in manufacturing (Spitz-Oener, 2006). And finally, after the fall of the Iron curtain and German reunification in 1990, a large inflow of

[33] Bratsberg et al. (2010) find a similarly large decline in employment for migrant workers who arrived during the 1970s in Norway. While in the Norwegian context this decline in employment was spread over 15-20 years, the drop in employment was much more sudden in Germany. Our observations here are also consistent with evidence on high unemployment and welfare dependence among Turkish migrants in the 1990s in Germany(Uhlendorff & Zimmermann, 2014; Riphahn, 2004; Riphahn et al., 2013). While these studies had limited data for earlier years, we show that these labor market disadvantages have not been around forever, but evolved in the early 1990s due to changing economic conditions.

FIGURE 3.8: THE 1990S EMPLOYMENT COLLAPSE

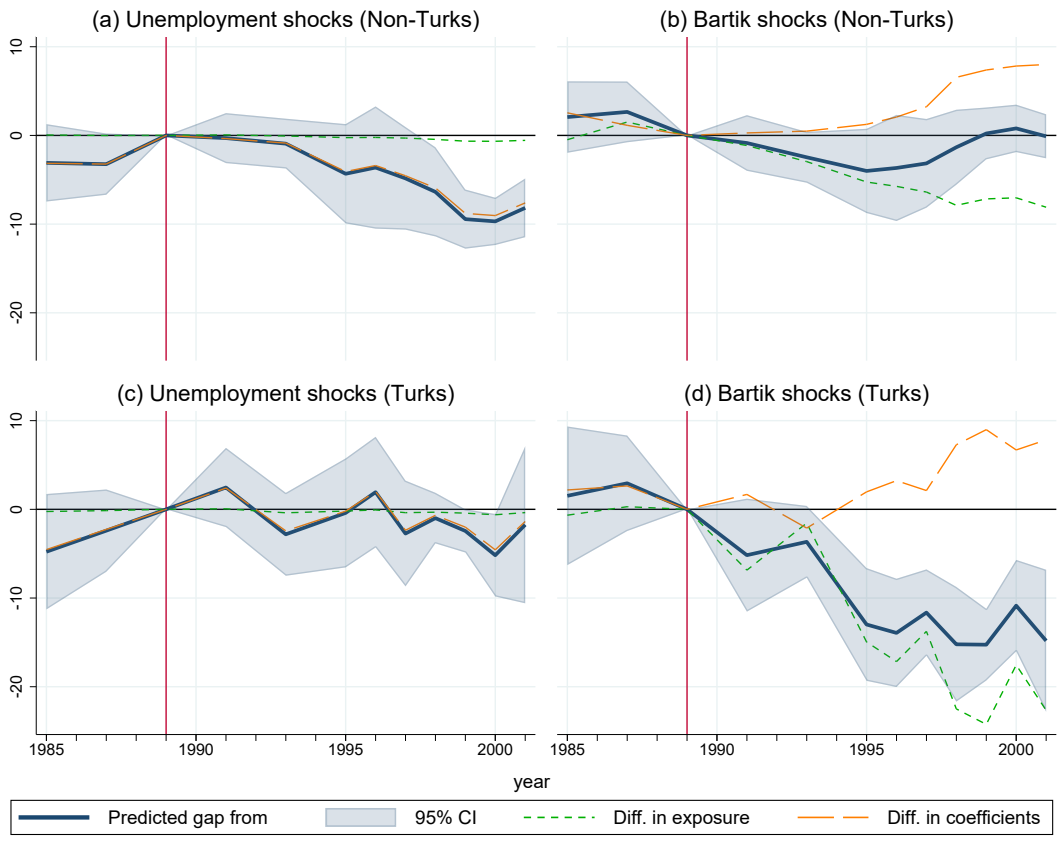


Notes: Results are based on a regression of the individual immigrant-native gaps as defined in equation (3.1) on a full set of age and year dummies (see Appendix 3.A.5 for details). Sub-figures (a)-(c) show the actual immigrant-native employment gap as defined in eq. (3.A.2) (solid lines) and the age-specific component as defined in eq. (3.A.3) (dotted lines). Sub-figure (d) shows actual gaps only.

new immigrants (see Figure 3.1), as well as increased trade exposure to Eastern European countries.

To probe these explanations, we assign to each individual the regional unemployment shock during the 1993 recession (measured as the 1989-1997 increase in the unemployment rate at the federal state level) and an aggregate proxy for structural change (measured on the level of immigrant cohorts or birth years for natives). Specifically, we measure structural change as a Bartik-shifter that predicts how much the employment of each group was expected to change based on their allocation across industries in 1989 and industry-wide employment trends between 1989 and 1997 (See Appendix 3.A.6 for details). We then use Oaxaca-Blinder decompositions to study whether the employment gaps between immigrants and natives as shown in Figure 3.8 are due to immigrants being clustered in regions and industries that were more heavily exposed to adverse shocks, or due to immigrants being generally more sensitive to adverse economic conditions (see Appendix 3.A.7 for methodological details).

FIGURE 3.9: DETERMINANTS OF THE 1990S EMPLOYMENT COLLAPSE



Notes: Results from Oaxaca-Blinder decompositions (See Appendix 3.A.7 for methodological details). Including all migrant cohorts that arrived before 1988. The thick blue line plots the predicted immigrant-native gap that can be explained by regional 1989-1997 unemployment shocks (Sub-figures (a) and (c)) and cohort-level Bartik shifters (Sub-figures (b) and (d)).

Figure 3.9 shows the results, where the thick blue line represents the change in the employment gap explained by each shock (change in regional unemployment or industry-level employment), the dotted green line represents the component that is due to differences in exposure (i.e. whether immigrants were allocated into regions or sectors that were struck by more adverse shocks) and the orange dashed line the component that is due to differences in sensitivity (i.e. immigrants being more strongly affected by a given shock than natives). Sub-figure 3.9a suggests that increasing unemployment rates indeed contributed to the widening of employment gaps between immigrants and natives – in particular after the 1993 recession. This is entirely driven by the higher sensitivity of immigrants to a given unemployment shock (difference in coefficients) and not by immigrants systematically sorting into regions with higher exposure. For sectoral decline, the pattern is the opposite (Sub-figure 3.9b), as differences in exposure (i.e. immigrants having sorted into declining sectors) entirely explain the negative employment trend in

the early 1990.[34] This pattern is particularly pronounced for Turks (Sub-figure 3.9d): in 1997, the entire employment gap of about 15 percentages points (averaging over the different arrival groups) can be explained by their unfavorable allocation into declining industries. Parallel work by Wiedner & Giesecke (2022) also attributes the widening labor market gaps to structural change, but does not emphasize the sudden timing of the Turks' employment collapse.

Using panel data, Chapter 4 provides evidence that younger Turkish migrants were not only very susceptible to structural transformation, but also to new immigration in the early 1990s. Selective return migration is identified as a reason why Turks were more sensitive to these shocks than other immigrants: While "guest workers" from Southern European countries were very likely to return to their home when they lost their jobs, Turks tended to stay in Germany and to apply for unemployment benefits – probably because of unfavorable economic and political perspectives in their home country at the time. Nevertheless, the results in Figure 3.9 confirm that worsening economic conditions amplified the immigrant-native gap in the early 1990s, with both regional variation in the severity of 1993 recession as well as the declining fortune of certain industries contributing to this pattern. These results support the finding that immigrants are more vulnerable to economic downturns, as they are more likely to work in volatile sectors or precarious employment relations (Bratsberg et al., 2006; Dustmann et al., 2010), which is also in line with previous debates on segmented labor market theory (Doeringer & Piore, 1971). They are also related to findings by Kogan (2004) and Uhlendorff & Zimmermann (2014) that sectoral and other job characteristics contributed to the dynamics of unemployment among Turkish and other "guest workers". However, a new observation here is that low employment rates among Turkish immigrants are not a long-lasting phenomenon, but the result of an abrupt decline in the early 1990s. One reason why this observation has not been made before might be that it requires large consistent data sets over a longer time horizons.

3.7.2 Recent Refugee Migration

Motivated by the observation that integration profiles are quite predictable (Section 3.5), we study the likely implications for two large recent refugee waves arriving from Syria and other countries around 2015, and from Ukraine in 2022.[35] Despite wide-spread solidarity, the challenges related to the integration of such large refugee cohorts have been one of the leading policy issues and a source of major concern in large parts of the population. The policy response was intended to avoid mistakes made in the past, with a

[34] The fact that the difference in coefficients (orange line, see Appendix 3.A.7 for details) is positive reflects that the employment gap would have widened even more if native's employment rate would have responded as elastically to their positive sectoral shock as immigrant's employment responded to their negative sectoral shock.

[35] As a consequence of armed conflicts in regions of the Middle East and Africa, the number of refugees in Germany increased by about 1.2 million between 2013 and 2018, reaching a sharp peak in late 2015. The most important origin countries were Syria, Afghanistan, Iraq, Iran, Eritrea, Pakistan, Nigeria and Somalia. Only a few years later, the Russian invasion of Ukraine led to another peak in refugee arrivals with around 670,000 registered refugees by June 2022 and probably more who had not yet been registered.

stronger emphasis on the provision of language courses and other integration measures (such as job counseling). One relevant question is therefore whether the labor market integration of recent refugees is developing more favorably than for similar cohorts in the past. A second, related question is whether their long-term integration trajectories can be predicted based on the experience from these earlier arrivals. To address these questions, we complement the microcensus with individual-level data from the IAB-BAMF-SOEP survey for the years 2016-2020, which is representative of refugees who arrived to Germany between 2013 and 2016 (see Section 3.3.2).

2015 refugee arrivals. Figure 3.10a compares the actually observed employment profile of refugees who arrived between 2013 and 2016 with the progress that we would expect based on the pattern observed for earlier migrant cohorts. Specifically, the solid line shows the *actual* employment gap of refugees observed in the IAB-BAMF-SOEP data relative to the corresponding Germans of the same age and observation year. The dashed orange line represents the *predicted* employment gap, based on the integration of earlier cohorts with high share of refugees observed in the microcensus, accounting for the age composition and education of the 2013-16 refugee cohort (as described further in Appendix 3.A.8). During the first years after arrival, the actual employment gap is slightly larger than the predicted gap, but after about three years, recent refugees catch up and are more likely to be employed than earlier refugee cohorts with similar education and age.

These findings are consistent with evidence by Brücker, Fendel, Guichard, Gundacker, Jaschke, Keita, Kosyakova & Vallizadeh (2020), who combine the IAB-BAMF-SOEP with an earlier sample from the SOEP to show that after a slower start three years after arrival, recent refugees start to overtake earlier refugee cohorts who arrived in 1990-2013 in terms of employment. Brücker et al. (2020) mention two potential explanations for this pattern. On the one hand, it could reflect Germany's stronger emphasis on language acquisition in Germany's revamped integration policy, delaying labor market entry but improving long-run prospects. Indeed, in line with this hypothesis we observe that refugees with favorable perspectives of staying and immediate access to integration and language courses experienced *lower* initial employment rates, but quicker employment growth than refugees with unfavorable prospects (see Appendix Figure 3.A9).[36]

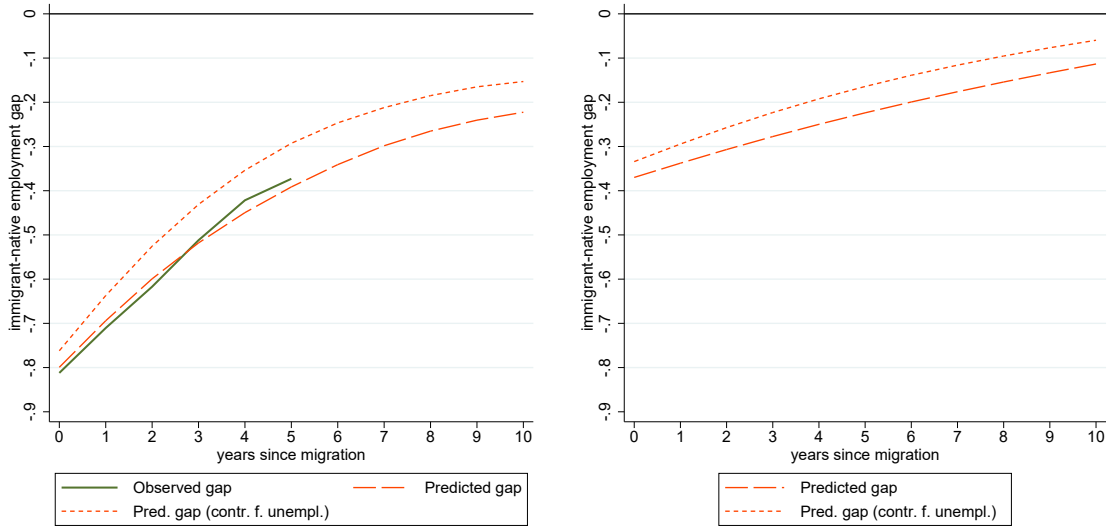
On the other hand, recent refugees might have benefited from unusually favorable labor market conditions, with the unemployment rate at a historic low in 2018.[37] To explore this hypothesis, we construct another prediction that accounts for economic conditions by including an interaction between years since migration and regional unemployment

[36] In 2016 the Federal Office for Migration and Refugees (BAMF) classified asylum seekers from Syria, Iraq, Eritrea, Iran and Somalia as having "good perspectives of staying" because more than 50% of asylum claims from these countries were accepted. Only asylum seekers from these countries were eligible for language and integration classes and labor market support even before a decision on their asylum claim was made. Immigrants from all other countries usually had to wait until they had been granted asylum, before enrolling.

[37] Several studies underpin the importance of local economic conditions and attitudes for the short- and medium run integration of refugees (Aksoy, Poutvaara & Schikora, 2020; Jaschke, Sardoschau & Tabellini, 2021; Barreto, Berbée, Torres, Lange & Sommerfeld, 2022).

FIGURE 3.10: EMPLOYMENT GAPS OF RECENTLY ARRIVED REFUGEES

(A) 2013-2016 REFUGEE COHORTS (B) UKRAINIANS



Notes: **Figure (a):** Solid green line: Actually observed immigrant-native employment gaps from IAB-BAMF-SOEP survey, estimated non-parametrically based on eqs. (3.2) and (3.1). Orange dashed and dotted lines: Predicted gaps estimated parametrically based on the Microcensus (including cohorts since 1974), accounting for age, education, refugee share (dashed line) and the regional unemployment rate in 2021 (dotted line). See Appendix 3.A.8 and eq. (3.A.10) for details. Characteristics for the new refugee cohorts are taken from the IAB-BAMF-SOEP survey (Figure a) and from Ukrainian immigrants in the most recent microcensus wave 2015 (Figure b).

rates (assuming that these rates remain constant after 2020). The implied employment gaps (Figure 3.10a, dotted line) are now 5-10 percentage points smaller than the actually observed gaps. We conclude that when taking into account that the macro-economic conditions were unusually favorable, the integration of the 2015 refugee cohort has in fact been slower than for earlier cohorts. One potential reason for this could be the sheer size of the refugee cohort, which increases the competition for jobs among immigrants (Albert, Glitz & Llull, 2021).

We may go one step further and predict the likely long-term trajectories for the 2013-2016 cohorts. For this purpose, we include the initial employment gap as an additional predictor, so as to use the best information available at arrival for predicting integration in later years (See Appendix 3.A.8 for details on the methodology). The resulting forecast (Appendix Figure 3.A8) is very close to the actual integration trajectory that we can observe during the first five years since migration. For the following years, our forecast predicts the employment gap to narrow further, before widening again slightly (reflecting the tendency of immigrant-native gaps to widen at older age among earlier cohorts) to stabilize at around 25 percentage points.

2022 Ukrainian arrivals. In comparison, our predictions for the employment profile of Ukrainian refugees are more favorable (Figure 3.10b). Since representative microdata on Ukrainian refugees living in Germany are not yet available, we impute their age composition and average educational outcomes from previous Ukrainian immigrants in the

microcensus wave 2015.[38] To be consistent with the rest of our study, predictions are made for Ukrainian men even though the majority of recent arrivals are women. For this reason, these figures should be interpreted with caution and as a comparative benchmark to other groups. Nevertheless, they illustrate the comparatively high labor market potential of Ukrainian arrivals (Brücker, 2022).

The predicted initial employment gap of Ukrainians is less than half the size of the 2013-2016 refugee cohort, reflecting substantially higher education levels (42.5% of Ukrainians vs. 18.6% with tertiary education and 95.0% vs. 56.6% with secondary education, respectively).[39] This applies to both the initial gaps in employment (predicted to be 37 percentage points) as well as the longer-term gaps (predicted to be around 10% one decade after arrival). Taking into account that Ukrainians are immediately granted refugee status and labor market access without lengthy application processes (which should aid integration, Fasani et al., 2021a), these results are likely to represent a lower bound.

3.8 Conclusions

With Germany now the world's second most important migrant destination, the integration of more than 13 million foreign-born has become a leading policy issue. Our aim was to provide insight into how well arrivals over the past 50 years integrated into the German labor market, drawing on pooled waves from the microcensus that offer broader and more representative coverage than previous work on register or survey-based sources.

While varying across groups, the integration profiles follow a few key patterns. First, employment profiles tend to be concave, with low initial employment but rapidly increasing employment in the first years after arrival (*convergence*). This resembles the shape of employment profiles in other countries, such as the US. However, income gaps *widen* with more time in Germany (*divergence*). This pattern is in stark contrast to the US, where immigrants have traditionally enjoyed strong assimilation in earnings – although more recent cohorts experienced less convergence (Borjas, 2015). Second, despite the initial catch-up, the employment gaps do not close in the first generation. Ten years after arrival, the average employment gap to similarly aged natives is 10 percentage points, with much heterogeneity across groups. This is again in stark contrast to the US, where immigrants have *higher* employment rates than natives (Cadena et al., 2015). We observe little convergence after the first decade, except for refugees, who have particularly low initial employment but experience more sustained gains over time. Third, labor market gaps close partially in the second generation. This intergenerational progress is particularly pronounced for income, as the average gap closes by about 75%. These findings resemble evidence from the US , where wage gaps on average shrink by roughly 70%

[38] The implied composition in terms of secondary schooling, university attendance and age composition (in the age group 18-58) are very similar to pre-war Ukrainian census data. Ukrainian women have a similar educational level as Ukrainian men.

[39] Specifically, 42.5% of all Ukrainian immigrants in the last wave of the microcensus aged 18-58 have a tertiary education. This share is similar to the reported tertiary share in Ukraine itself, which amounts to 31% for Ukrainians older than age 10 (see the CReAM database on Ukrainian immigration).

between the first and second generation, disappearing for some, but not for all migrant groups. Employment gaps close by only 30% between first and second generation.

We also explored why integration outcomes vary across groups and time. We found that integration outcomes are quite predictable, as most of the variability can be explained by a limited set of cohort characteristics that are readily available to policymakers. The same characteristics can explain why the labor market gaps between immigrants and natives have changed over time. The *raw* employment gap 10 year after arrival has widened substantially – by more than 15 percentage points over five decades. However, accounting for changes in composition and economic conditions, the labor market prospects of immigrants have remained stagnant.

This lack of improvement is puzzling. Having been exposed to immigration much later than the US, European countries may have lacked the experience to foster successful integration (Dustmann et al., 2013). But following this argument, we would expect the institutional setting and thus integration outcomes to improve over time. On the one hand, reforms of German citizenship law that introduced clear pathways to naturalization do not appear to have clear effects on males' labor market integration (Gathmann & Keller, 2017 - in contrast to other settings, Fasani, Frattini & Pirot, 2022). On the other, the literature has identified various policies that improve the integration process (Foged, Hasager & Peri, 2022), some of which have been adopted by Germany that revamped its integration policy in the 2000s: The increased emphasis on language training as embodied in the 2005 immigration act and on occupational recognition are likely to improve labor market outcomes of participants strongly (Brücker, Glitz, Lerche & Romiti, 2021; Anger, Bassetto & Sandner, 2022). However, the effects of these policies are not reflected on the aggregate level. A potential explanation would be low uptake and poor targeting of integration policies. Indeed, Kogan (2016) documents that Germany ranks high compared to other European countries with respect to policy intentions (provision and access to integration support), but that only very low shares of recently arrived immigrants actually participate in training programs or job search assistance.

The perhaps most striking pattern in our data is the sudden collapse of employment among some immigrant groups in the early 1990s. After two decades of high attachment to the German labor market, the employment rate of Turkish "guest worker" cohorts collapsed by nearly *30 percentage points* (relative to natives, and more in absolute level). This observation implies that policy makers have to worry not only about the successful integration of new immigrant arrivals, but also a sudden evaporation of those gains when labor markets are hit by major economic downturns.

In the final parts of our study we studied the integration path of *recent* arrival cohorts. The 2015 European refugee crisis and the 2022 Russo-Ukrainian war led to the arrival of million of refugees, and the challenges related to their integration has been an important (for some years, the most important) policy issue in Germany. We find that the cohort arriving around 2015 had larger initial gaps but found employment at a slightly higher rate than earlier cohorts with similar characteristics. While this may

reflect Germany's revamped integration policy (delaying labor market entry but improving long-term employment prospects), it also reflects unusually favorable labor market conditions: accounting for the record low level of unemployment, the 2015er cohort integrated *less* rapidly than earlier arrivals. Their predicted long-term gaps in employment (about 20-25 percentage points) are more than twice as large as the corresponding gap for Ukrainian refugees (about 10 percentage points). Of course, any such forecast depends on many future economic trends and other unknowns.

More generally speaking, the experience from more than 50 years of labor market integration of immigrants in Germany shows that immigration has become indispensable for the German economy and that many migrant groups have managed to achieve substantial employment rates and decent incomes. However, structural barriers to integration persist and have not shrunk over time. Against this background, the high labor market risks of immigrants in view of looming recessions and structural changes should not be underestimated, not only for the many recent arrivals, but also for established cohorts. It seems questionable whether existing policies and institutions will suffice to tackle them if needed.

3.A Appendix

3.A.1 Institutional Details of Immigration and Integration since 1955

Recruitment of "guest workers". Because it was the original intention that foreign workers recruited between 1955 and 1973 would soon return to their home countries, they obtained only temporary (usually one-year) residence and working permits. Since these permits were linked to their jobs and assigned to firms by the Federal Employment Office, their freedom of settlement was very limited (Danzer & Yaman, 2016). Upon pressure from firms that had an interest in reducing the rotation of workers, temporary residence permits could be renewed since 1965. Since 1971, 5-year residence permits could be issued for foreigners that were living in Germany for 5 years. Family reunification was possible during the recruitment period.

Consolidation period. On one side, family migration was facilitated as more countries joined the European Community[40], granting freedom of settlement and free labor market access to their citizens. On the other, economic and political instability in Turkey and eligibility of foreigners to family benefits ("Kindergeld") reduced incentives to return home (Velling, 1993). During the 1980s, a series of policies was pursued that was meant to (1) restrict new immigration, (2) to reduce the movement of foreigners into metropolitan areas where already large migrant communities existed, and (3) to encourage return migration by offering financial incentives and counseling.

Refugee migration in the 1980s and 1990s. Until the 2000s, applying for asylum was de facto the only legal way for non-EU citizens of obtaining residence in Germany, except for family reunification and the naturalization of ethnic Germans. During the 1980s, policies were introduced that limited the options for appealing against asylum decisions, limiting the freedom of settlement and movement, introducing visa bans for origin countries and making the asylum procedures stricter. While accepted refugees had labor market access, a one-year long employment ban for asylum applicants was increased to two years in 1982 and to five years in 1986. In 1991, these employment bans were abolished again. In the early 1990s, unprecedented violent attacks against refugee accommodations took place at several locations. In 1992/1993, the parliament adopted the so-called "asylum compromise" including institutional amendments and strictly reducing the access to the asylum system for persons that entered German territory from countries defined as safe, including all neighbor states. Between 1997 and 2000, a general employment ban for asylum applicants was put into practice again, before it was replaced by a priority review ("Vorrangprüfung"), meaning that asylum seekers would only get permissions to work in jobs where no other suitable candidate could be found.

[40] Most notably the recruitment countries Italy, Greece, Spain and Portugal.)

Eastern European immigration since the Fall of the Iron Curtain. After the fall of the Iron curtain, not only refugee migration from increased strongly, also many ethnic Germans (*Spätaussiedler*) living in Eastern Europe took the opportunity to migrate to Germany. Around 1990, almost 400,000 ethnic Germans arrived each year who were – by the constitution – given German citizenship and labor market access if they could prove their German descent (Glitz, 2012). We exclude ethnic Germans from the entire study because as German citizens they cannot be identified in the microcensus before 2005. At the same time, also internal migration and commuting from former East German states increased strongly (Fuchs-Schündeln & Schündeln, 2009). While the German labor market was otherwise closed to Eastern Europeans in the early 1990s, bilateral agreements established a number of exceptions (Werner, 1996) for seasonal workers, cross-border commuters and so-called "posted workers" (*Werkvertragsarbeitnehmer*). Posted workers would only obtain very short-run and temporary residence permits (up to three months).

Immigration in the 2000s. In the years 2004 and 2007, 12 new member states joined the European Union. The German government – out of fear for labor market competition and "wage dumping" – decided to restrict labor market access and the freedom of residence for citizens from these countries for as long as possible, until 2011. At the same, time a fundamental shift in Germany's immigration policy took place and entry barriers for labor migration of high-skilled workers from non-EU countries were successively reduced. Although only a few thousand foreign IT-specialists benefited the "Green-Card-Initiative" of the year 2000, it marks a turning point in the public debate. A "real" immigration law outside the asylum system that granted residence and employment permits to substantial number of foreigners who had to meet certain requirements, passed in 2005. It acknowledged for the first time that the German economy was in need of immigration because skilled labor was becoming increasingly scarce as the society was aging. Unlike before, high skilled foreigners, including foreign graduates from German universities could receive temporary work permits if they found a job to earn their livings in Germany. Over the following years, several amendments were made that lowered labor market barriers further, such as for skilled workers without academic degree. In contrast to previous legislation, the immigration law of 2005 for the first time explicitly envisaged language and integration courses. Consequently, Germany's labor market was considered to be one of the most open among OECD countries (OECD, 2013).

Recent refugee migration. Asylum seekers faced significant labor market barriers, until being accepted as a refugee, which could take more than a year during the 2015/2016 peak (including priority checks and the requirement to obtain an individual working permit). A strict employment ban only applied for the first three months after arrival. Asylum applications from countries defined as safe were massively complicated, affecting in particular refugees from many African states and the West-Balkans. In order to create alternative migration options than applying for asylum, labor market access was eased for citizens of West-Balkan states in 2016. In contrast, Ukrainians who fled the war

in their home country in 2022 were granted asylum and immediate labor market access without an asylum procedure.

3.A.2 Immigrant Definitions and Naturalizations

In the microcensus immigrant status can only be identified based on nationality, because there is no information on country of birth available. Until 1995, the questionnaire includes only one item on whether respondents possess German citizenship or not and for non-Germans one additional item on the foreign nationality. Since 1996, all respondents, including those with German nationality, are asked whether they possess a second nationality. Since 2005, the microcensus includes additional information on whether and when a respondent has obtained the German nationality by naturalization, and on previous nationalities.

These expanding questionnaires reflect the changing citizenship law in Germany: Until the 1990s, only persons of ethnic German ancestry had the right to obtain German citizenship (with some exceptions for immigrants that lived in Germany for longer than 15 years and second-generation immigrants that were born in Germany). Against this background, we are very confident that the first nationality captures true immigrant status well until the mid 1990s, with the important exception of Ethnic Germans that arrived from Central and Eastern Europe that are excluded from this study.

Figure 3.A1 presents the size of the different cohorts (extrapolated to match population numbers) based on different migrant definitions over the census waves from 1976 till 2015. We only show numbers for males that have migrated to Germany at age 18 or older, also including people that are older than 58. The dotted lines represent the number of immigrants that only possess a foreign nationality and do not hold German citizenship. These are the immigrants that we can identify before 1996. The solid line additionally includes immigrants with double citizenship, corresponding to our definition of immigrants since 1996. At that point in time, none of the cohorts included any substantial number of dual nationals, which is to be expected because former law required foreigners to abandon other nationalities when obtaining German citizenship, which was only loosened by the new citizenship law in the year 2000. Finally, the dashed line additionally includes naturalized immigrants without foreign nationality (available since 2005). We exclude ethnic Germans and other immigrants that obtained the German nationality during their first year after arrival. Among immigrants from non-EU countries, a non-negligible fraction eventually gets naturalized.

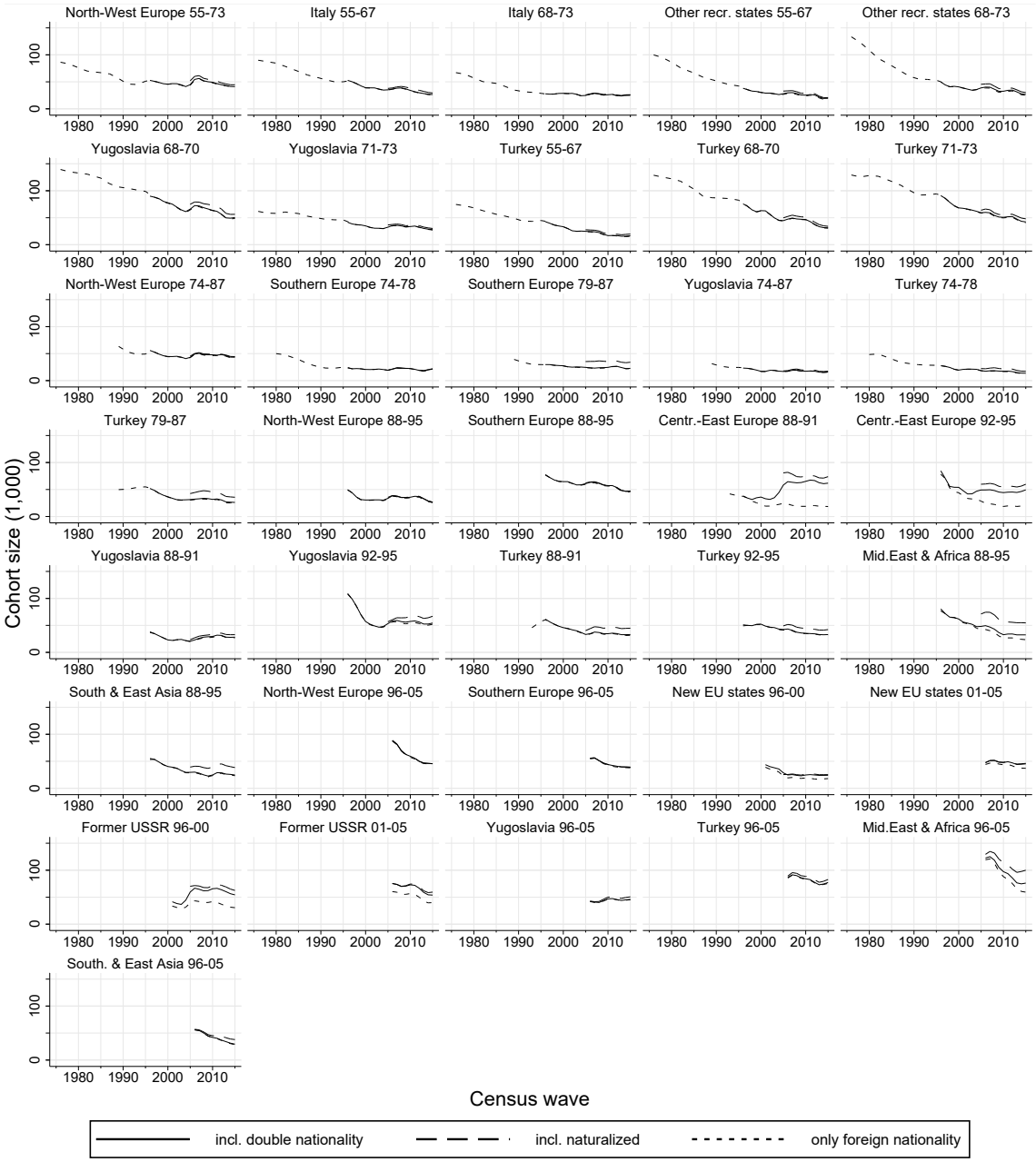
In Figures 3.A2 and 3.A3 we similarly plot employment shares and mean personal real incomes of cohorts, using the three different immigrant definitions pointed out in the previous paragraph. If there were important deviations between the solid line (including double nationality, the migrant definition we adopt throughout the main parts of the paper) and the dashed line (including naturalized immigrants), this would be an indication that selective naturalization was likely to bias our results. We find such deviations only for three cohorts (Turkey 1974-78 and 1979-87, Middle East and Africa 1988-1995). For

that reason we are confident that our results on employment and income gaps between immigrants and natives is not strongly biased because of selective naturalization.

TABLE 3.A1: DEFINITION OF ORIGIN REGIONS

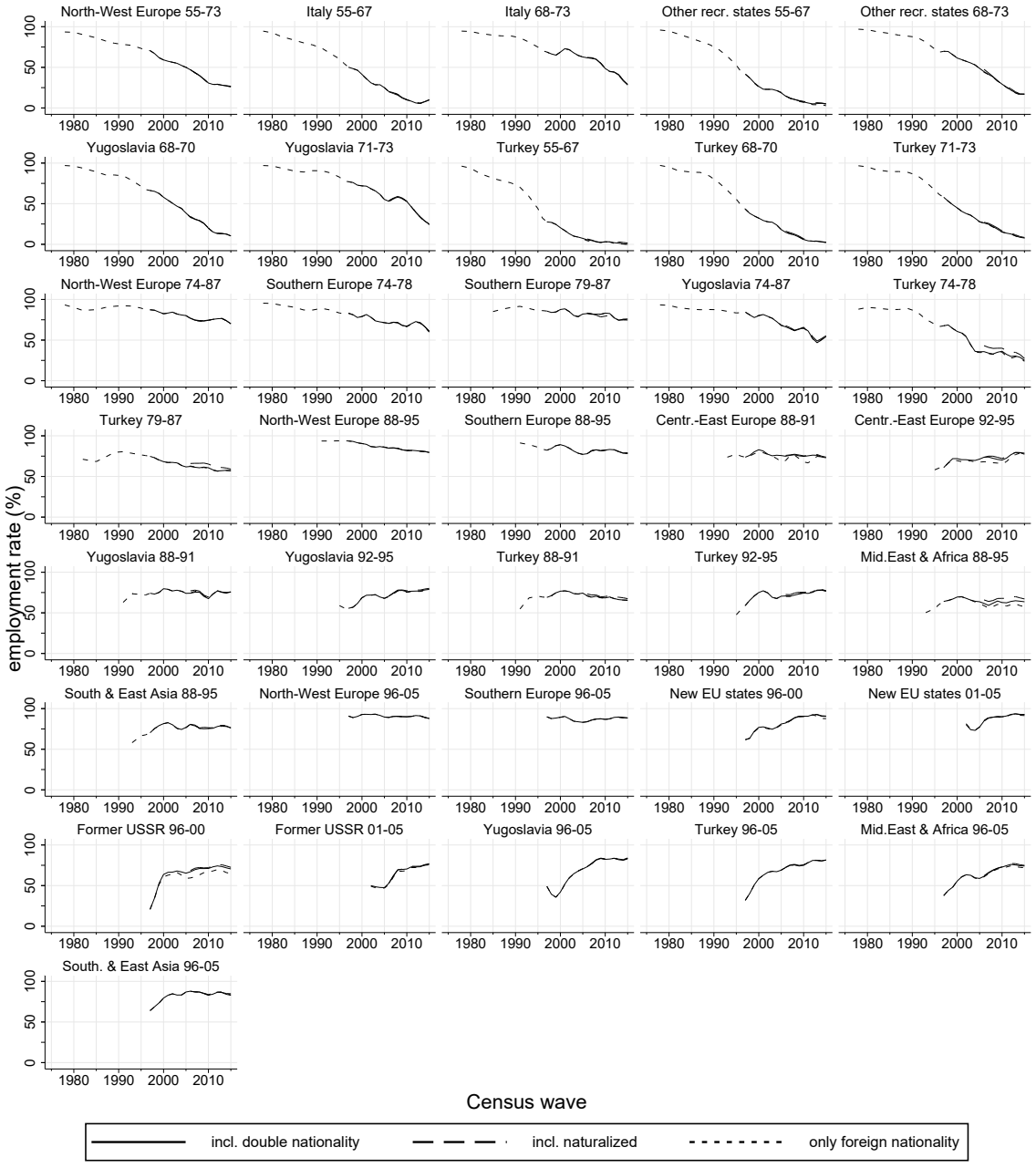
Label	Countries
North-West Europe	Austria, Belgium, Denmark, Finland, France, Iceland, Ireland, Liechtenstein, Luxembourg, Netherlands, Norway, San Marino, Sweden, Switzerland, United Kingdom
Southern Europe	Greece, Italy, Portugal, Spain
Italy	Italy
Other recruitment states	Greece, Morocco, Portugal, Spain, Tunisia
Eastern Europe	Former USSR (including Estonia, Latvia, Lithuania), Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, excluding former Yugoslavia
Fomer USSR	Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan (excluding the new EU members Estonia, Latvia and Lithuania)
New EU member states	Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.
(Former) Yugoslavia	Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia, Serbia, Slovenia
Turkey	Turkey
Middle East and Africa	All African states plus Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen
Central and East Asia	All East Asian and South-East Asian states plus Afghanistan, Bangladesh, Buthan, India, Iran, Pakistan, Nepal, Sri Lanka

FIGURE 3.A1: DIFFERENT IMMIGRANT DEFINITIONS: COHORT SIZE



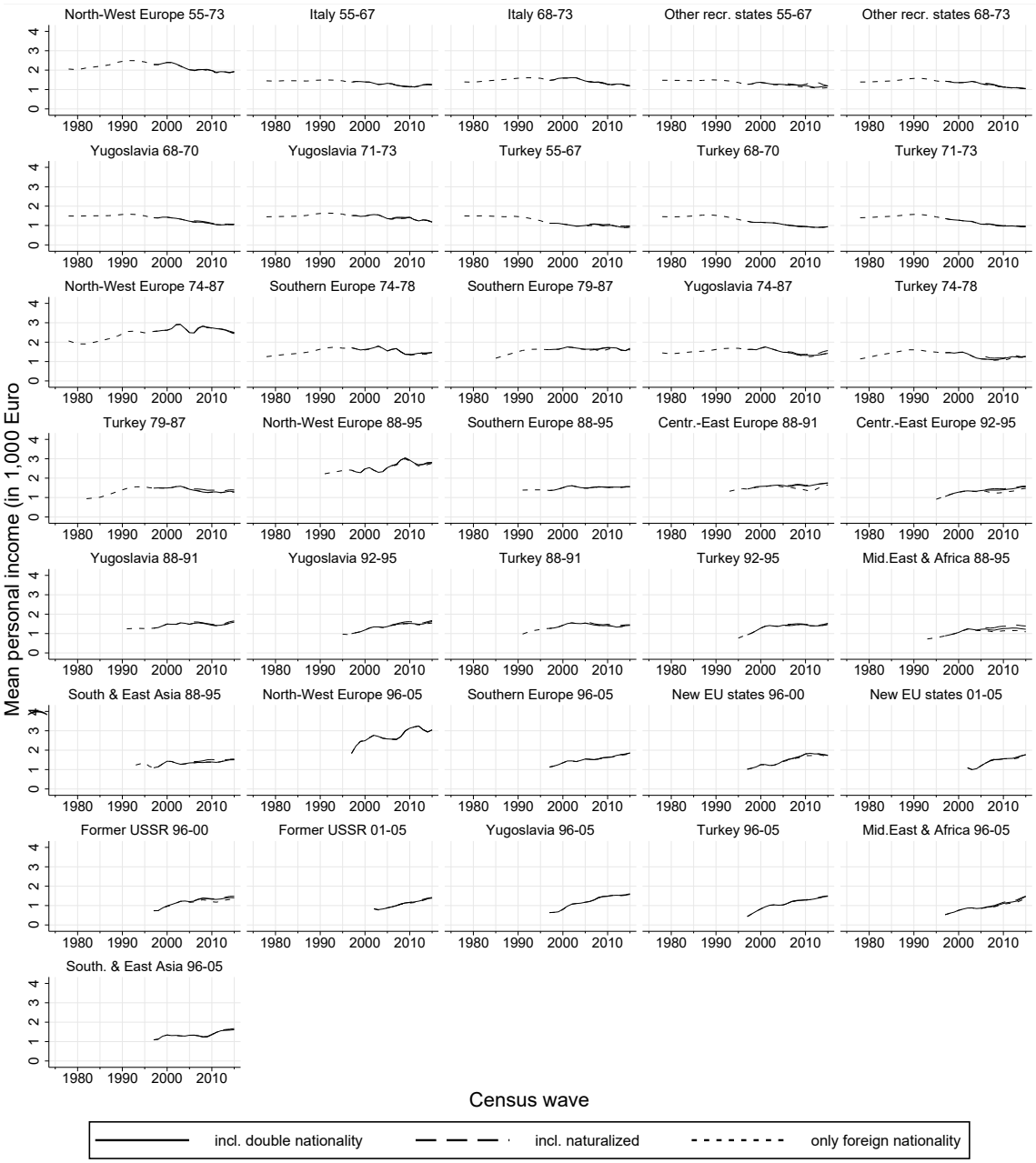
Notes: Observation numbers (in 1,000; extrapolated with microcensus weights to match total population numbers; Male migrants aged 18 or older - including those above 58). Short dashed line: Migrants holding a foreign nationality, but no German nationality (since 1976). Solid line Additionally migrants holding both, German and foreign nationality (since 1995). Long dashed line: Additionally naturalized migrants who lost foreign nationality when adopting German citizenship (since 2005).

FIGURE 3.A2: DIFFERENT IMMIGRANT DEFINITIONS: EMPLOYMENT RATES



Notes: Mean employment rates (Male migrants aged 18 or older - including those above 58). Short dashed line: Migrants holding a foreign nationality, but no German nationality (since 1976). Solid line Additionally migrants holding both, German and foreign nationality (since 1995). Long dashed line: Additionally naturalized migrants who lost foreign nationality when adopting German citizenship (since 2005).

FIGURE 3.A3: DIFFERENT IMMIGRANT DEFINITIONS:
MEAN INDIVIDUAL INCOME



Notes: Mean real individual post-tax income (in 1,000 Euro - reference year 2010; Male migrants aged 18 or older - including those above 58). Short dashed line: Migrants holding a foreign nationality, but no German nationality (since 1976). Solid line Additionally migrants holding both, German and foreign nationality (since 1995). Long dashed line: Additionally naturalized migrants who lost foreign nationality when adopting German citizenship (since 2005).

3.A.3 Other Outcomes: Welfare Dependency and Intermarriage

Figure 3.A4 shows welfare dependency, defined by any kind of public transfers as the main source of individual income.[41] It is higher among immigrants than among natives, for all cohorts except arrivals from North-West Europe. Upon arrival, the gap is particularly large for refugee cohorts, because refugees are eligible for asylum-related benefits while facing restrictions in labor market access (see Appendix 3.A.1 for details). Welfare dependency upon arrival is low for some Turkish cohorts. Turks often rely on support from relatives during the first year ("assistance by friends and family" in the microcensus), which is less likely to be the case for other origin groups with a smaller diaspora in Germany. Welfare dependency tends to decline quickly in the first years after arrival, mirroring the profiles for employment (Figure 3.2). However, some groups, in particular Turkish cohorts, develop higher welfare dependency in the second and third decade after arrival (as previously noted by Riphahn, 2004; Riphahn et al., 2013). While dependency also increases among their native counterparts (due to the correlation of years since migration with age), the increase is much more pronounced among immigrant cohorts – resulting in divergence, rather than convergence. We thus find non-monotonic integration profiles: after large improvements in the early years after arrival, the immigrant-native gap stagnates and then widens again for some groups – both in employment (Figure 3.2) and welfare dependency (Figure 3.A4).

Table 3.A2 shows intermarriage and intramarriage rates of cohorts upon arrival and ten years after arrival.[42] While our focus is on labor market outcomes, assortative patterns can be an indicator for social integration or segmentation, which may interact with economic integration (Meng & Gregory, 2005). The observed patterns are very similar to Constant, Nottmeyer & Zimmermann (2012) and reflect cultural and religious distances to the native German population (as well as a decline in the overall importance of marriage over time). North-West-European immigrants are most likely to be married to a German spouse, in particular when accounting for their low baseline probability of being married. They are the only group that is continuously more likely to be married to a German spouse rather than to a spouse of the same nationality group. Reasons might include small cultural differences and relatively low incentives to move for economic reasons. In contrast, the vast majority of immigrants that arrived previous to 1987 from the traditional "guest worker" recruitment countries, in particular from Turkey, married within their communities: Ten years after arrival, about 90% of all Turks that arrived between 1955 and 1973 and about 80% of 1974-1987 arrivals were married to a Turkish spouse, but only about 1% respectively 7% to a German spouse.

[41] These include unemployment benefits, social assistance, but also other programs like asylum seeker benefits, parental benefits or student aid (BAFoeG). Pensions from the pension insurance are *not* considered.
[42] Intramarriage refers to be married to a spouse of the same origin group (the same groups our cohorts are based on); intermarriage refers to being married to a German spouse. Since "German spouse" refers to the current nationality, it excludes foreign-born who hold only the German nationality. Non-married persons are treated as "zeros".

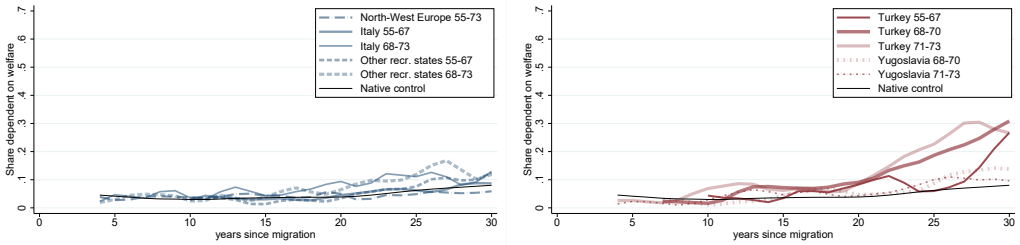
TABLE 3.A2: INTER- AND INTRAMARRIAGE RATES OF IMMIGRANT COHORTS

	at arrival		10 years after arrival	
	intermarriage	intramarriage	intermarriage	intramarriage
1. Recruitment period (1955-1973)				
North-West Europe 55-73			38.0%	30.6%
Italy 55-67			15.8%	67.9%
Italy 68-73			13.7%	63.8%
Turkey 55-67			1.4%	91.6%
Turkey 68-70			0.8%	89.8%
Turkey 71-73			0.9%	90.7%
Yugoslavia 68-70			4.7%	82.0%
Yugoslavia 71-73			3.5%	79.0%
Other recr. states 55-67			4.1%	73.8%
Other recr. states 68-73			2.3%	57.4%
2. Consolidation period (1974-1987)				
North-West Europe 74-87	13.8%	35.3%	40.9%	22.7%
Southern Europe 74-78	3.2%	47.1%	21.5%	55.4%
Southern Europe 79-87	6.6%	39.7%	14.9%	54.1%
Yugoslavia 74-87	8.7%	51.0%	14.0%	65.4%
Turkey 74-78	3.9%	65.6%	5.5%	83.2%
Turkey 79-87	4.3%	45.5%	8.8%	77.3%
3. Fall of the Iron Curtain (1988-1995)				
North-West Europe 88-95	9.3%	21.5%	28.3%	16.9%
Southern Europe 88-95	1.5%	46.5%	9.4%	59.6%
Centr.-East Europe 88-91	11.8%	55.7%	21.4%	58.8%
Centr.-East Europe 92-95	12.7%	54.7%	18.7%	58.4%
Yugoslavia 88-91	11.9%	58.1%	19.6%	59.2%
Yugoslavia 92-95	2.6%	60.1%	17.5%	59.6%
Turkey 88-91	6.9%	72.5%	12.1%	72.3%
Turkey 92-95	13.3%	67.5%	22.9%	63.6%
Mid.East & Africa 88-95	12.3%	20.3%	23.9%	32.9%
Centr. & East Asia 88-95	4.2%	34.9%	11.9%	60.4%
4. Period of East-West integration 1996-2005				
North-West Europe 96-05	5.8%	20.6%	27.5%	21.2%
Southern Europe 96-05	2.9%	24.2%	7.6%	40.2%
New EU states 96-00	14.7%	29.2%	18.2%	48.7%
New EU states 01-05	11.3%	33.0%	11.4%	48.4%
Former USSR 96-00	20.0%	57.0%	20.4%	58.5%
Former USSR 01-05	23.7%	50.8%	27.2%	52.1%
Yugoslavia 96-05	15.0%	37.0%	21.6%	54.2%
Turkey 96-05	39.6%	41.7%	42.0%	41.6%
Mid.East & Africa 96-05	22.4%	15.2%	20.6%	32.1%
Centr. & East Asia 96-05	5.0%	26.9%	15.5%	46.6%

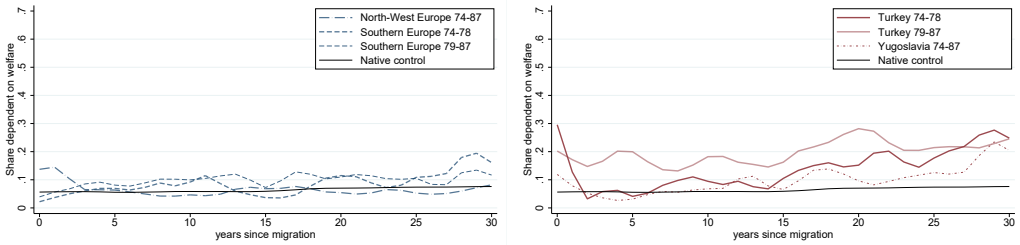
Notes: Percentages are taken from the entire sample, regardless of marital status. Non-married persons are included in the percentages and treated as zeros. Intramarriage refers to be married to a spouse of the same nationality group (the same groups our cohorts are based on); intermarriage refers to being married to a spouse that only holds the German nationality.

FIGURE 3.A4: WELFARE DEPENDENCY OF IMMIGRANT COHORTS

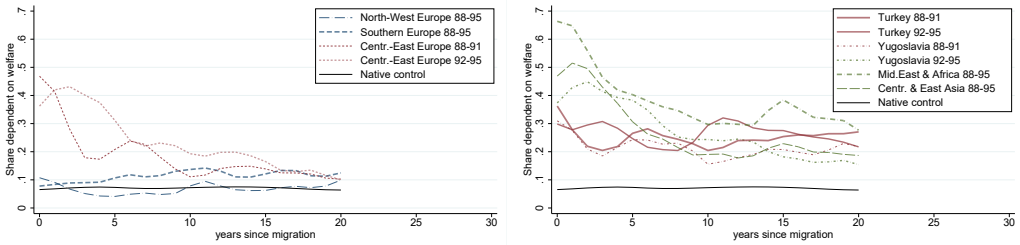
(A) ARRIVALS 1955-1973



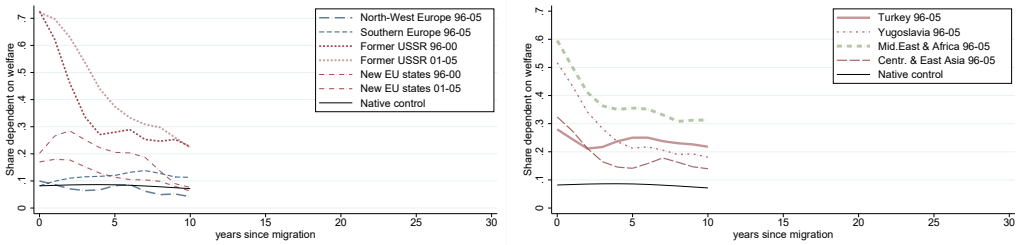
(B) ARRIVALS 1974-1987



(C) ARRIVALS 1988-1995



(D) ARRIVALS 1996-2005



Notes: Share of persons whose main source of income is public transfers. This includes unemployment benefits and social assistance, but also other programs like asylum seeker benefits, parental benefits, student aid (BAFoeG). Pensions are *not* considered. The counterfactual native welfare shares are for natives of the same age observed in the same year as the immigrant sample (estimated according to equation 3.2).

3.A.4 Individual vs. Cohort-Level Predictors

Are *individual characteristics* or *group-level characteristics*, i.e. the average characteristics of the "cohort" defined by arrival period and region of origin (Section 3.3.3), more predictive of labor market success? If the aim is to predict individual outcomes, the answer may appear obvious – a person's own education should be more predictive for that person's success than the average attainment of the group he happens to belong to. Interestingly, that is not generally the case, and cohort-level characteristics tend to be important predictors even conditional on the persons' own characteristics.

To illustrate this point, we regress the individual labor market gaps $\hat{y}_i^{gap}$ at around 10 years after arrival as defined in equation (3.1) on

$$\hat{y}_i^{gap} = \alpha + \beta X_i^{individual} + \gamma X_{c(i)}^{cohort} + \varepsilon_i$$

where $X_i^{individual}$ a vector of individual level controls and $X_{c(i)}^{cohort}$ cohort-level controls at the time of arrival (the results are similar if $X_{c(i)}^{cohort}$ are measured at the time of observation). We standardize all regressors such that the coefficients represent the effect of a one-standard deviation increase in the respective variable.

The results are shown in panel (A) of Table 3.A3 for employment and panel (B) for income. Apart from the (adjusted) R-square on the individual level, we also report the corresponding R-square on the cohort level, defined as the share of variation between cohorts that can be explained by the covariates. The coefficients on education (column 1) have the expected sign[43] and are highly significant, explaining about 60% of the variation in employment gaps between immigrant groups. In contrast, the mean age of the cohort or the overall migrant share at their arrival (the population share of immigrants regardless of origin who arrived within the previous 5 years) explain little of the differences in integration outcomes (columns 2 and 3).[44] The latter result contrasts with recent findings by Albert et al. (2021) for the US, who find that the immigrant-native gaps are larger when larger number of immigrants arrive in the US at the same time.

As is perhaps intuitive, the cohort-level variation can be at least as well explained by cohort average as by individual-level characteristics (cf. columns 4-6 of Table 3.A3). Cohort-level controls can explain about two thirds of the between-cohort variation in employment and income after 10 years (column 3) while individual-level characteristics are predictive for cohort-level employment gaps but not for income (column 6 of same tables).

[43] The negative sign on cohort-share university degree turn positive when including a time-trend. The negative sign is thus probably driven by improving education over time that is not reflected in improving employment.

[44] In interpreting the coefficient on age at migration, it is helpful to consider two distinct mechanisms: On the one hand, highly-educated immigrants with university diplomas tend to migrate at higher ages than other immigrants, which probably explains the positive coefficients in columns (2). On the other hand, younger migrants might be more willing or able to accumulate country-specific human capital. These arguments are consistent with the observation that once we condition on education the coefficient on age at migration flips sign and becomes negative.

More surprising is that the cohort-level characteristics can be also better predictors for *individual* outcomes. For example, the cohort shares with a school or university degree explain 2.7% of the variation in individual employment, while own education only explains 2.1%. For income, individual education becomes more predictive, as having a university degree is associated with substantially higher individual incomes. Finally, column (7) shows that cohort-controls (in particular the cohort share with a completed school degree) remain predictive even after conditioning on an individual's own education and age at arrival.

Why are cohort-level characteristics so predictive? One potential explanation is that the composition of an arrival cohort does indeed have a causal effect on their members because of peer or network effects. For example, Borjas (1992) introduces the concept of "ethnic capital" to characterize the ethnic context in which individuals take decisions, e.g. to invest in country-specific human capital. An alternative explanation is that the discernible membership to certain groups leads to labor market disadvantages because of discrimination. For example, Weichselbaumer (2019) shows that among female job applicants with identical resumes, those with a Turkish name receive much fewer callbacks. Finally, the reported education of an immigrant may simply not be very informative about his or her actual level of productive knowledge and skills, partly because educational credentials may not be fully translatable from origin to destination country (see Fortin, Lemieux & Torres, 2016; Basilio et al., 2017). The individual-level information is then only a noisy proxy, and cohort averages constructed over many individuals may be a more precise signal for individual skills. Irrespectively of which explanation applies, we can conclude that cohort-level statistics are the most relevant predictors for the labor market success of immigrant cohorts, and that individual characteristics yield little additional power (compare R-squared: cohort-level for columns (3) and (7)).

TABLE 3.A3: INDIVIDUAL- VS. COHORT-LEVEL PREDICTORS OF LABOR MARKET GAPS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (A): Employment gaps (Percentage points, 10 years after arrival)							
School degree (cohort mean)	5.23*** (0.58)		5.49*** (0.66)				4.83*** (0.66)
University degree (cohort mean)	-1.72* (0.89)		-0.97 (0.77)				-1.11 (0.72)
Cohort size at arrival (cohort mean)		1.23 (1.00)	1.25 (0.75)				1.00 (0.69)
Age at migration (cohort mean)		1.09 (1.18)	-1.54 (1.18)				-1.48 (1.09)
School degree (individual)				2.09*** (0.28)		2.06*** (0.28)	1.51*** (0.24)
University degree (individual)				0.81 (0.56)		0.94 (0.57)	1.42*** (0.36)
Age at migration (individual)					-2.47*** (0.72)	-2.59*** (0.72)	-3.00*** (0.71)
Observations	21,231	21,231	21,231	21,231	21,231	21,231	21,231
Adj. R^2 (individual)	0.03	0.00	0.03	0.02	0.00	0.02	0.05
Adj. R^2 (coh.-level)	0.59	0.05	0.64	0.61	0.07	0.70	0.68
Panel (B): Income gaps (2010 Euro, 10 years after arrival)							
School degree (cohort mean)	179.9*** (31.0)		204.6*** (28.0)				201.2*** (29.4)
University degree (cohort mean)	82.9 (60.9)		156.3*** (56.4)				81.9 (55.5)
Cohort size at arrival (cohort mean)		-19.9 (24.0)	25.3 (20.6)				21.1 (22.9)
Age at migration (cohort mean)		-6.7 (49.2)	-206.1*** (52.0)				-167.6*** (52.1)
School degree (individual)				42.2*** (6.4)		38.4*** (5.9)	21.6*** (3.7)
University degree (individual)				256.5*** (59.9)		272.7*** (59.7)	259.0*** (34.7)
Age at migration (individual)					-322.3*** (42.9)	-346.8*** (39.8)	-350.4*** (34.0)
Observations	20,573	20,573	20,573	20,573	20,573	20,573	20,573
Adj. R^2 (individual)	0.04	0.00	0.06	0.06	0.04	0.11	0.16
Adj. R^2 (coh.-level)	0.43	0.00	0.68	0.15	0.00	0.17	0.65

Notes: The regressions include immigrants 9-11 years after arrival. Dependent variables: Predicted individual gaps according to equation (3.1). Panel (A): Employment or in education (in percentage points). Panel (B): Real individual post-tax income (in 2010 Euros). Cohort mean variables are measured upon arrival. Cohort size is measured as the share of all working-age immigrants that arrived in the 5 years previous to an immigrant's arrival year in the working-age population in the arrival year. Explanatory variables are standardized (mean=0, standard deviation=1). Standard errors are clustered on the cohort level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

3.A.5 Decomposition of Age-Components in Employment Gaps

We estimate for each immigrant group I separately:

$$\hat{y}_i^{gap} = \lambda^I + \sum_{a=18}^{58} \delta_a^I A_{ia} + \sum_{t=1976}^{2015} \gamma_t^I \Pi_{it} + \varepsilon_i \tag{3.A.1}$$

Qhere $\hat{y}_i^{gap}$ denotes the immigrant-native employment gap for immigrant individual i predicted according to equation (3.1). λ^I is a (cohort-specific) constant, A_{ia} a dummy for age a and Π_{it} a dummy for year t. For individual i, observed at age $\dot{a}$ in year $\dot{t}$, $\hat{y}_i^{gap}$ can be predicted by:

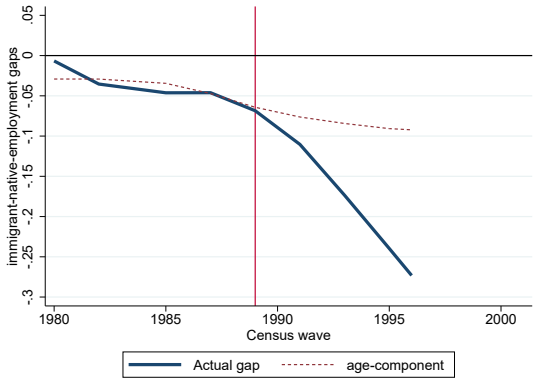
$$\hat{\dot{y}}_i^{gap} = \hat{\lambda}^I + \hat{\delta}_{\dot{a}}^I + \hat{\gamma}_{\dot{t}}^I \tag{3.A.2}$$

We can drop the year-parameter $\hat{\gamma}_{\dot{t}}^I$ to obtain what we call the age-component, which is the part of the gap that can be explained by the age structure of immigrant groups, which could be for instance be caused by systematically earlier retirement of immigrants compared to natives:

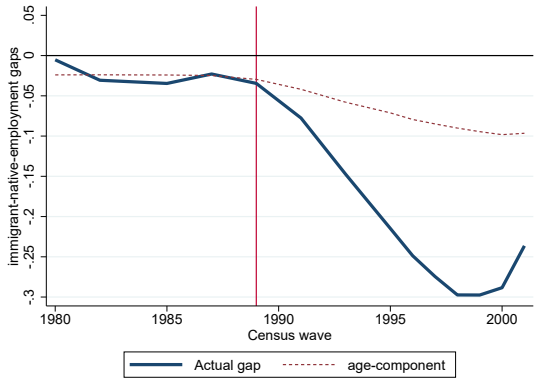
$$\hat{\dot{y}}_i^{age-component} = \hat{\lambda}^I + \hat{\delta}_{\dot{a}}^I \tag{3.A.3}$$

FIGURE 3.A5: AGE-COMPONENTS OF EMPLOYMENT GAPS BY BIRTH YEARS

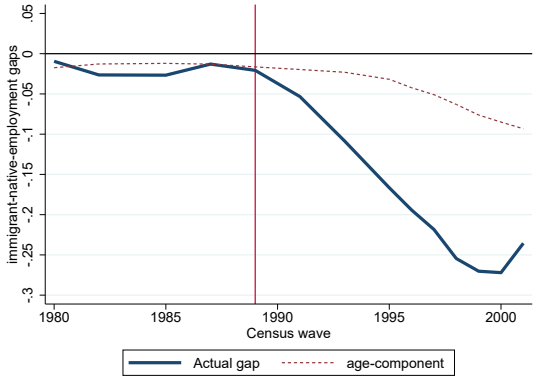
(A) TURKEY, BIRTH YEARS 1935-1939



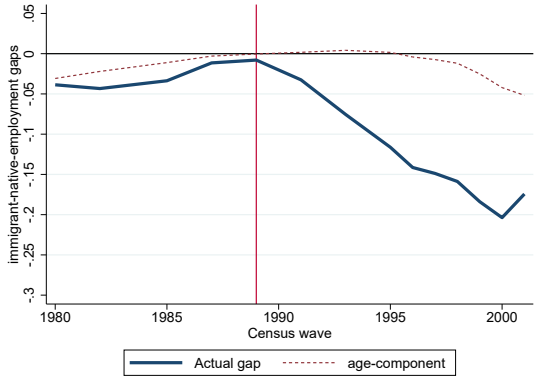
(B) TURKEY, BIRTH YEARS 1940-1944



(C) TURKEY, BIRTH YEARS 1945-1949



(D) TURKEY, BIRTH YEARS 1950-1954



Notes: Turks, arrived 1955-1978. The solid lines show the predicted immigrant-native employment gap as defined in equation (3.A.2) and the dotted line the age-specific component as defined in equation (3.A.3).

3.A.6 Unemployment- and Bartik-Shocks

Table 3.A4 illustrates that immigrants were not generally living in regions with higher unemployment rates in 1991 (column 1), but in regions where unemployment increased stronger between 1991 and 1997 ("Unemployment shock", column 2). Turkish immigrants were already allocated in the most unfavorable regions before their employment rates collapsed, both in terms of baseline unemployment as well as unemployment growth. A second potential reason why immigrant employment rates dropped could be their concentration in industries that went into decline during the 1990s. To explore this mechanism, we predict how much the employment of each immigrant cohort would have dropped based on their 1989 allocation into industries and industry-wide employment trends between 1989 and 1997. We define this type of Bartik-shifter as:

$$BS_{1997-1991,c} = \sum_{s=1}^{N} \left(\frac{emp_{cs,1989}}{emp_{c,1989}} \times \frac{emp_{s,1997}}{emp_{s,1989}} \right) \tag{3.A.4}$$

where $emp_{cs,1989}$ is the number of workers in cohort c working in industry sector s in 1989[45], $emp_{c,1989}$ the total number of employed persons in cohort c and $emp_{s,1997}$ respectively $emp_{s,1989}$ total employment (including immigrants and natives) in sector s in the years 1997 and 1989. $BS_{1997-1991,c}$ thus captures the employment trend (between 1989 and 1997) of the industry sectors that a group c was employed in in the base year 1989. Column (3) of Table 3.A4 thus shows that employment in the sectors in which natives were employed in 1989 grew on average by 4.5% until 1997, whereas many immigrant cohorts worked in sectors that on average shrank. Again, Turkish cohorts were already previously allocated to the most unfavorable industries, with predicted employment declines of up to 9.2%. More recent immigrants from predominantly EU countries instead selected in sectors with even better growth prospects than natives. This could be due to younger and higher educated cohorts sorting into booming industries, whereas older migrants that have already spend about 20 years or more in Germany are less able to change into promising jobs.

[45] Harmonizing industry sectors over the census waves is not straight-forward because the used industry classifications change frequently. Additionally, many (service industries) employ only very small numbers of migrants. We therefore aggregate sectors to the following broad industries: 1 Agriculture, forestry and fishing; 2 Mining, quarrying, manufacture of non-metallic mineral products; 3 Manufacture of food and beverage products; 4 Manufacture of textiles, wearing apparel, leather and related products; 5 Manufacture of wood and products of wood, paper and paper products; 6 Manufacture of coke, refined petroleum, chemicals and chemical products, rubber and plastic products; 7 Manufacture of basic metals, metal products except machinery; 8 Manufacture of electrical equipment, computers, electronic and optical products; 9 Manufacture of machinery, motor vehicles and equipment; 10 Construction, Electricity, gas and water supply, waste management, repair and installation; 11 Wholesale and retail trade; 12 Transport and storage; 13 Accommodation and food service activities; 14 Other services.

TABLE 3.A4: EXPOSURE OF COHORTS TO ECONOMIC SHOCKS DURING THE 1990S

Cohort	Unemp. rate 1991	Δ Unemp. rate 1997-1991	Bartik shock 1997-1989
Natives	6.37	4.70	4.49
North-West Europe 55-73	6.11	4.72	5.88
Italy 55-67	5.84	4.71	-0.38
Italy 68-73	5.84	4.76	0.22
Yugoslavia 68-70	5.47	4.74	-0.33
Yugoslavia 71-73	5.53	4.75	-1.15
Turkey 55-67	6.93	4.87	-4.94
Turkey 68-70	6.73	4.86	-8.03
Other recr. states 55-67	5.96	4.75	-4.57
Other recr. states 68-73	6.35	4.70	-5.88
North-West Europe 74-87	5.93	4.77	7.95
Southern Europe 74-78	6.16	4.78	3.69
Southern Europe 79-87	5.79	4.81	8.25
Yugoslavia 74-87	6.33	4.71	2.08
Turkey 71-73	6.38	4.79	-9.20
Turkey 74-78	6.71	4.70	-6.51
Turkey 79-87	6.76	4.78	-3.96

Notes: Column (1): Mean unemployment rate at residence in 1991; Column (2): Change in mean unemployment rate at residence 1997-1991; Column (3): For definition of the Bartik shock see equation (3.A.4)

3.A.7 Methodological Details: The 1990s Employment Collapse

We estimate the following parametric regressions that are based on equations (3.3) and (3.4) for the census waves 1976-2001. Specifically, we model the outcome y_{ictr} (employment or income) for immigrant i in cohort c in calendar year t and region r as:

$$\begin{aligned} y_{ictr} =& \delta^I A_i + \alpha^I YSM_i + \sum_{t=1985}^{2005} \gamma_t^I \Pi_t + \sum_{t=1985}^{2005} \mu_t^I \Pi_t \times UR_{shock1997-1989,r} + \\ & \sum_{t=1985}^{2005} \xi_t^I \Pi_t \times BS_{1997-1989,c} + \varepsilon_n \end{aligned} \tag{3.A.5}$$

where A_i is a third-order polynomial in age, YSM_i a third-order polynomial of years since migration and Π_t denotes a set of indicator variables for each calendar year (where we omit the year 1989 as base year). $UR_{shock1997-1989,r}$ denotes the regional unemployment shock of the 1993 recession (unemployment rate in 1997 - unemployment rate in 1989) and $BS_{1997-1989,c}$ is a type of Bartik-shifter (details above in appendix 3.A.6) that varies between immigrant cohorts. The corresponding regression model for native individual n, where the subscript c refers to 5-year birth cohorts reads:

$$\begin{aligned} y_{nctr} =& \delta^N A_n + \sum_{t=1985}^{2005} \gamma_t^N \Pi_t + \sum_{t=1985}^{2005} \mu_t^N \Pi_t \times UR_{shock1997-1989,r} + \\ & \sum_{t=1985}^{2005} \xi_t^N \Pi_t \times BS_{1997-1989,c} + \varepsilon_n \end{aligned} \tag{3.A.6}$$

We estimate coefficients separately for natives and immigrants as a whole and *not* separately for different immigrant cohorts, because we are interested in average effects for immigrants. As is commonly done (Barth et al., 2004), we assume identical time effects for immigrants and natives $\mu^I = \mu^N$, but we allow the coefficients on age, unemployment shocks and Bartik shifters to differ between immigrants and natives.

Our goal is firstly to estimate how much of the unemployment collapse among immigrants in the 1990s can be explained by deteriorating labor market conditions and structural change and secondly whether immigrants were already previously allocated into regions or industries that were stronger affected or whether they were systematically more sensitive to these shocks compared to natives.

For that purpose we perform Oaxaca-Blinder decompositions of the parts in the immigrant-natives gaps that can be explained by the severity of the regional unemployment shocks Δgap_t^{UR} (and perform identical decompositions for the Bartik-shifters):

$$\begin{aligned}\Delta gap_t^{UR} &= \hat{\mu}_t^I \bar{UR}_{shock1997-1989,r(i)} - \hat{\mu}_t^N \bar{UR}_{shock1997-1989,r(n)} \\ &= \underbrace{\hat{\mu}_t^I (\bar{UR}_{shock1997-1989,r(i)} - \bar{UR}_{shock1997-1989,r(n)})}_{\text{Difference in exposure}} + \underbrace{(\hat{\mu}_t^I - \hat{\mu}_t^N) \bar{UR}_{shock1997-1989,r(n)}}_{\text{Difference in coefficients}}\end{aligned} \tag{3.A.7}$$

The first component captures whether immigrants on average lived in regions that were stronger affected by increasing unemployment than the regions where natives lived ("Difference in exposure") and the second component whether immigrants were more negatively affected by a given increase in regional unemployment compared to natives ("Difference in coefficients").

3.A.8 Methodological Details: Refugee Application

We are interested in comparing the employment trajectories of recent refugee cohorts to the integration profiles of previous immigrant cohorts. In particular we ask which role the favorable labour market conditions in the late 2010s played.

In a first step, we estimate employment for immigrants and natives *in the microcensus data* using parametric equations that are similar to equations (3.3) and (3.4):

$$y_{ic} = \lambda^I + \delta^I A_i + \alpha^I YSM_i + \phi^I X_{ctr} + \chi^I X_{ctr} \times YSM_i + \sum_{t=1976}^{2015} \gamma_t^I \Pi_{it} + \varepsilon_i \tag{3.A.8}$$

$$y_n = \lambda^N + \delta^N A_n + \sum_{t=1976}^{2015} \gamma_t^N \Pi_{nt} + \varepsilon_n \tag{3.A.9}$$

where y is a dummy for employment of immigrant individual i from cohort c or native individual n. λ denotes a separate intercept immigrants I and for natives N.[46] A_i a vector of polynomials up to the power three for age and YSM_i up to third-order polynomials

[46] In this application we cannot estimate coefficients separately for different immigrant cohorts because we use them for out-of sample predictions where new immigrants belong to none of the cohorts the model is estimated on.

of years since migration. Higher order polynomials are not shown for simplicity. As previously,X_{ctr} a vector of control variables that vary between cohorts c, points in time t or regions r. X_{ctr} always includes the cohort-specific share of immigrants with a school degree as well as the share of immigrants with a university degree, measured immediately after arrival and the refugee share of each cohort. Depending on the specification, we additionally include regional unemployment rates. We fully interact all these control variables with the different polynomials of YSM_i to allow the integration trajectories to differ flexibly depending on education, refugee share and economic conditions. We include X_{ctr} only for immigrants and not for natives, because we are interested in unconditional, raw comparisons. The purpose of including group-level covariates is to account for differences in cohort composition between newer and older refugee groups and not to account for differences between immigrants and natives. For simplicity, consistency and in order to be able to perform out-of sample predictions, we assume that time effects for migrants and natives are identical ($\gamma_t^I = \gamma_t^N$).

In a second step, we use the microcensus-based coefficients $\hat{\lambda}^I$, $\hat{\lambda}^N$, $\hat{\delta}^I$, $\hat{\delta}^N$, $\hat{\alpha}^I$ and $\hat{\phi}^I$ from equations (3.A.8) and (3.A.9) to predict the individual immigrant-native wage gaps:

$$\hat{y}_{ic}^I - \hat{y}_{ic}^N = (\hat{\lambda}^I - \hat{\lambda}^N) + (\hat{\delta}^I - \hat{\delta}^N)A_i + \hat{\alpha}^I YSM_i + \hat{\phi}^I X_{ctr} + \hat{\chi}^I X_{ctr} \times YSM_i \qquad (3.A.10)$$

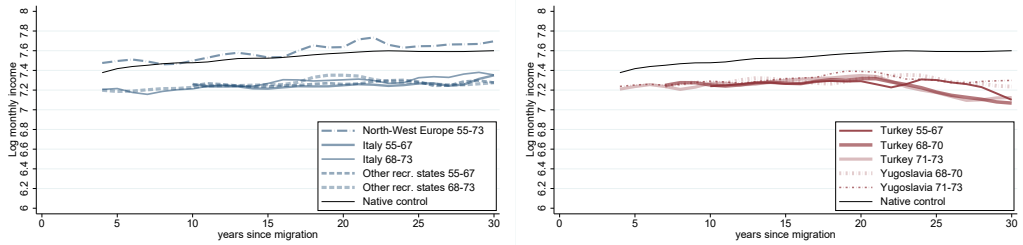
where X, A and YSM are taken from the newly arrived asylum seekers *from the IAB-BAMF-SOEP sample* of refugees. We extrapolate the data backwards also for the year 2015 based on retrospective questions on arrival date and date of first job in Germany.

For the second type of predictions that are shown in Figure 3.A8, where we are more interested in forecasting, we force the immigrant-specific intercept in equation (3.A.8) ($\lambda^I - \lambda^N$) to be equal to the cohort-specific employment gap at arrival. We also add the cohort-specific initial employment gap as additional control variable to the vector X_{ctr}. In addition we drop $\phi^I X_{ctr}$ and keep only the interaction of X_{ctr} with YSM. By doing so, we force the forecast to start at the true observed initial employment gap and avoid differences in initial gaps between the forecast and the observed integration profile.

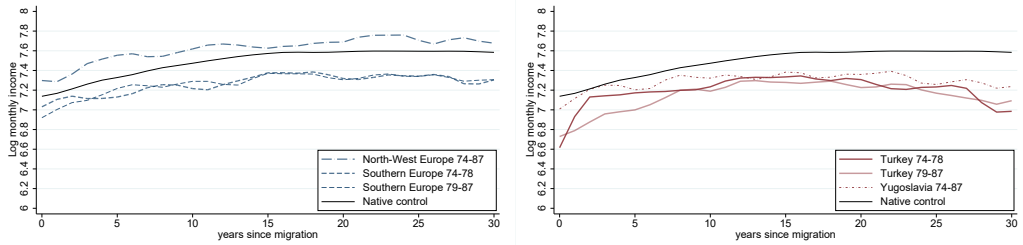
3.A.9 Additional Figures and Tables

FIGURE 3.A6: LOG MONTHLY INCOME OF IMMIGRANT COHORTS

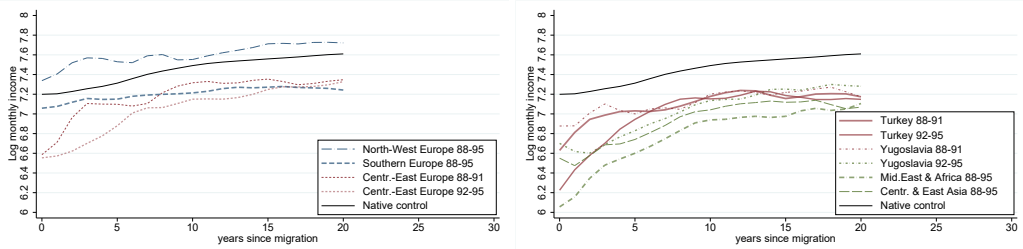
(A) ARRIVALS 1955-1973



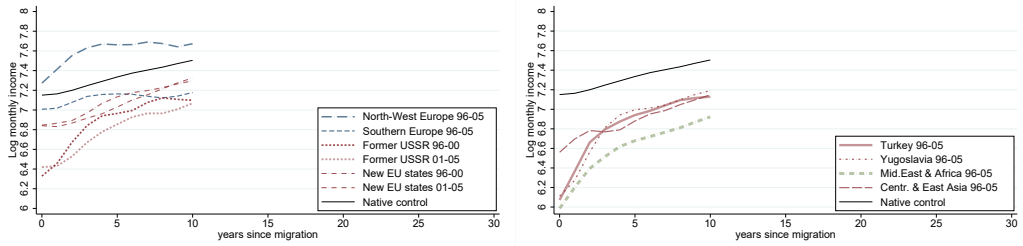
(B) ARRIVALS 1974-1987



(C) ARRIVALS 1988-1995

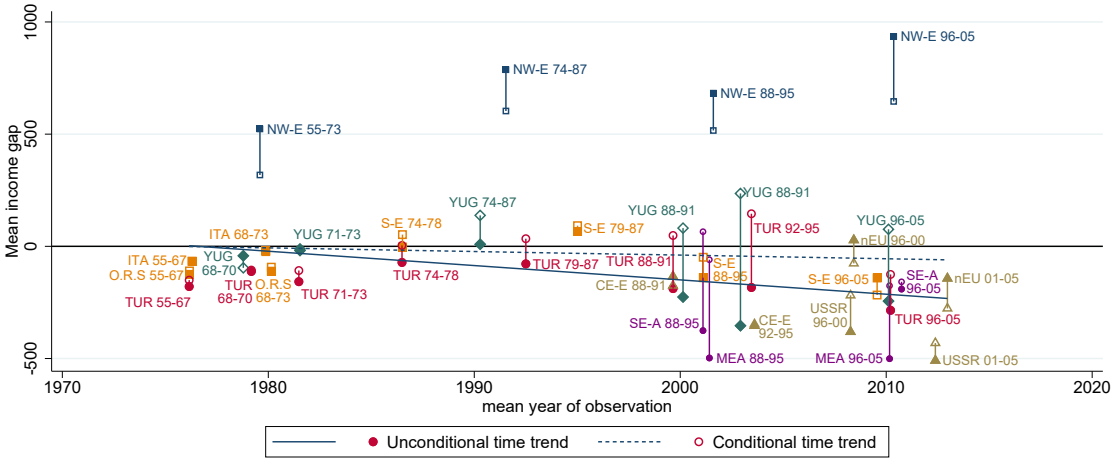


(D) ARRIVALS 1996-2005



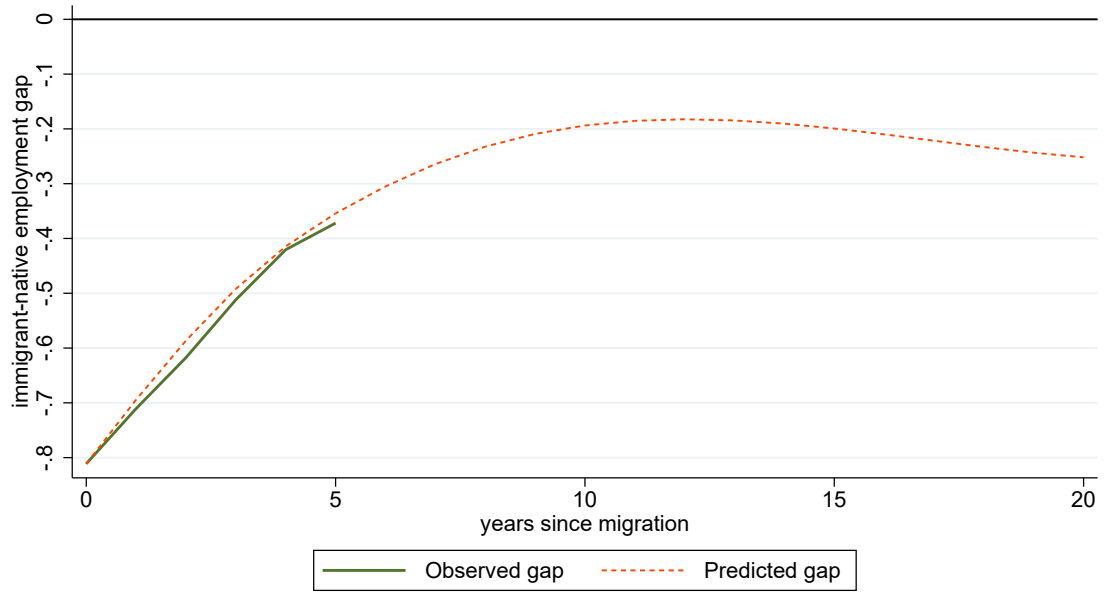
Notes: Log of mean personal income of different immigrant cohorts and a native control group by year since migration. We consider real individual post-tax income (measured in 2010 Euros). Income does not only consist of labor earnings, but also other forms of income like capital gains or welfare benefits. The counterfactual native employment rates are for natives of the same age observed in the same year as the immigrant sample (estimated according to equation 3.2).

FIGURE 3.A7: TIME TRENDS IN IMMIGRANT-NATIVE INCOME GAPS (10 YEARS SINCE ARRIVAL)



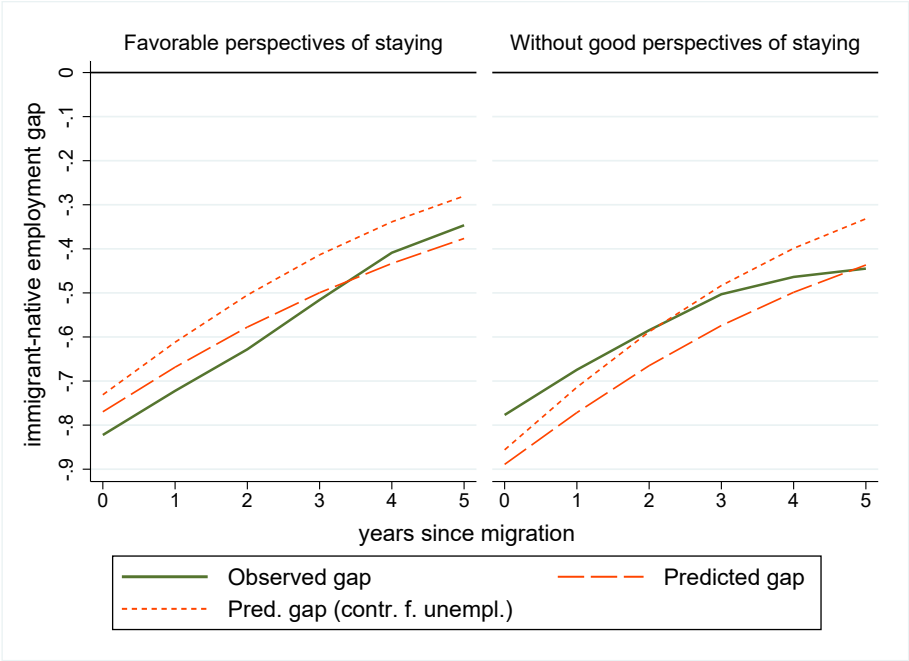
Notes: Filled markers and solid line: unconditional time trend in immigrant-native income gaps; Hollow markers and dashed line: conditional time trend. Time trends are measured as the predicted time trend plus the residuals from regressions in panel (B) of Table 3.3 and aggregated to the cohort level. Unconditional time trends refer to column (1) and conditional time trends to column (4), including controls for individual education, regional unemployment rate and cohort-level refugee share. For estimation, the year 1976 is rescaled to $year = 0$ (The first microcensus wave used in this study). The labels refer to region of origin (See Table 3.A1) and arrival year: CE-E: Central and Eastern Europe; ITA: Italy; MEA: Middle East and Africa; nEU: New EU member states; O.R.S: Other recruitment states; CE-A: Central and East Asia; S-E: Southern Europe; TUR: Turkey; YUG: (former) Yugoslavia.

FIGURE 3.A8: EMPLOYMENT FORECASTS FOR RECENTLY ARRIVED REFUGEES



Notes: Green line: Actually observed immigrant-native employment gaps from IAB-BAMF-SOEP survey, estimated non-parametrically based on eqs. (3.2) and (3.1). Orange dotted lines: Predicted gaps estimated parametrically based on the Microcensus (including cohorts since 1974), accounting for initial employment gap, age, education, refugee share and the regional unemployment rate in 2021. We force the forecast to start at the observed initial employment gap (see Appendix 3.A.8 for details.

FIGURE 3.A9: EMPLOYMENT GAPS OF REFUGEES BY PERSPECTIVES OF STAYING



Notes: Countries with good favorable perspectives of staying include Syria, Iraq, Eritrea, Iran and Somalia. Asylum seekers from other countries are classified as "withoug good perspectives of staying". Green line: Actually observed immigrant-native employment gaps from IAB-BAMF-SOEP survey, estimated non-parametrically based on eqs. (3.2) and (3.1). Orange dashed and dotted lines: Predicted gaps estimated parametrically based on the Microcensus (including cohorts since 1974), accounting for age, education, refugee share (dashed line) and the regional unemployment rate in 2021 (dotted line). See Appendix 3.A.8 and eq. (3.A.10) for details.

Chapter 4

Economic Shocks and the Integration of Migrant Workers

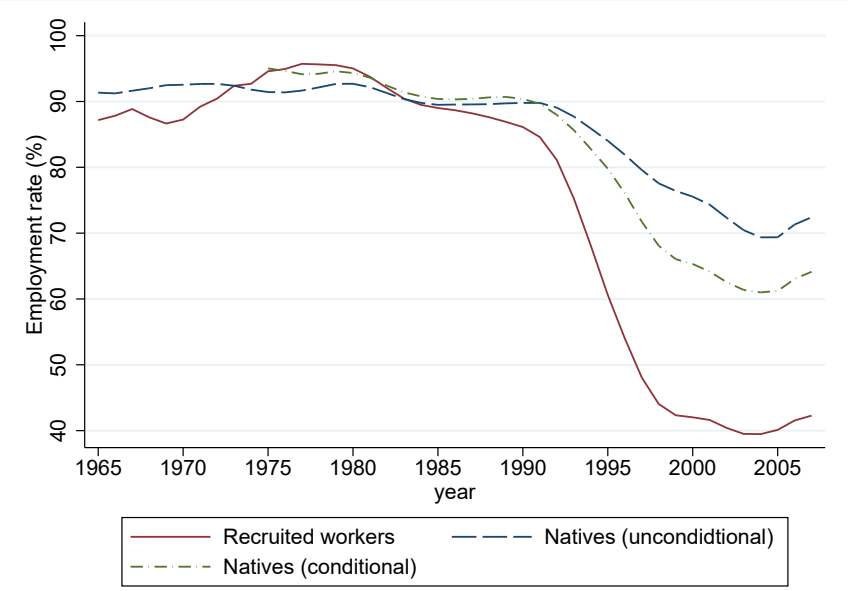
4.1 Introduction

In the economic literature, the integration of immigrants into the labor market has traditionally been viewed as a process of assimilation, in which migrants become more similar to native workers over time as they acquire country-specific human capital and their initial disadvantages in the labor market diminish (Chiswick, 1978; Borjas, 1985, 1995). Although the question whether first generation migrants fully assimilate remains debated, evidence from the US suggests that at least the wages of children of foreign-born parents fully catch up to natives (Card, 2005; Lubotsky, 2007). This study challenges the traditional notion of assimilation by showing that the labor market integration of immigrants is not always a unidirectional process. Even migrants who have lived in the host country for several decades and have had favorable starting conditions and stable working biographies can experience a dramatic decline in their labor market integration when economic conditions change.[1] This paper investigates the role of labor market shocks and changing economic conditions in contributing to such divergent integration, using the example of Turkish immigrants in Germany after the collapse of the Iron Curtain. The specific events examined in this study include the employment drop during the 1993 recession, new immigration, and task-biased technical change. The results suggests that economic downturns and new immigration cannot only slow down assimilation in wages and employment (Barth et al., 2004; Bratsberg et al., 2006; Albert et al., 2021), but also reverse it, even across generations. In times of persistently high migration flows and troubled economic outlooks, this is of particular policy relevance for many industrialized countries where large migrant cohorts are growing old.

The labor market experiences of foreign workers recruited by German firms during the 1960s and early 1970s from Southern Europe and Turkey are particularly interesting for several reasons: Firstly, this group is highly relevant in terms of size: Between 1955 and 1973, the share in foreigners in total employment rose from 0.4% to 10%, with Turks being the largest group. While these workers were originally intended to stay in Germany only temporarily, many did not leave and eventually brought their families. As the first large cohort of international migrants in Germany, the experiences of these so-called "guest workers" continues to shape public debates about immigration until today. Secondly, the first generation of recruited workers has now retired, allowing for the observation of their full labor market biographies, making them particularly useful for long-term studies. Specifically, this study is the first to use individual panel data dating back to the recruitment period. The BASiD dataset is based on pension accounts and covers the entire working biographies of these migrants in Germany, starting in 1951. Thirdly, the labor market trajectories of the Turkish recruited workers are characterized by divergence rather than convergence with native workers: Figure 4.1 illustrates that after several decades of relatively stable careers, employment rates of Turks who arrived in Germany before the recruitment stop in 1973 dropped from nearly 90% to just over 40%

[1] Bratsberg et al. (2010); Bevelander & Nielsen (2001) and Wiedner & Giesecke (2022) provide evidence on the deterioration of labor market outcomes over the lifecycle of non-European migrant workers in Norway, Sweden and Germany.

FIGURE 4.1: EMPLOYMENT RATES OF TURKISH RECRUITED WORKERS



Notes: Male Turks who started their first job in Germany before November 1973 in the BASiD. Unconditional counterfactuals predicted for natives with the same age composition as migrants; conditional counterfacutals additionally condition on the education, last occupation and last industry of migrants (Appendix 4.A.1).

between 1992 and 1998, much more than employment rates of natives with a similar age distribution (dashed line) or even of natives working in similar jobs (dash-dotted line). This decline is due to a rise in unemployment among Turks, while retirement or disability played only a minor role. While it is a well-established fact that Turks are generally more vulnerable and less integrated into the German labor market compared to many other migrant groups[2], to the best of my knowledge no other study has documented that this pattern was not obvious before the 1990s and the result of a sudden and dramatic decline within a few years (with the exception of parallel work by Wiedner & Giesecke, 2022, who do not focus on the specific timing of these events and cannot track individual migrants over time).[3]

While older Turkish migrants experienced a sharp decline in employment rates in the early 1990s, younger Turkish migrants also experienced a simultaneous decline in wages. Surprisingly, the labor market outcomes of migrants from other recruitment states did not change. To estimate the differential effects of various economic shocks on Turkish migrants compared to natives, this study employs individual fixed effects models and Oaxaca-Blinder decompositions. To account for the potential endogeneity of immigrant inflows and the employment drops during the 1993 recession, shift-share predictions and

[2] See for instance: Algan et al. (2010); Glitz (2014); Wunder & Riphahn (2013); Kogan (2011, 2004); Uhlendorff & Zimmermann (2014)

[3] One possible reason that the sudden decline in labor market outcomes for Turkish migrants in the early 1990s has often been overlooked is that previous studies on the integration of migrants in the German labor market have typically used the German Socio-Economic Panel (SOEP), which has relatively small sample sizes and only begins in 1984, missing the first 10-25 years of the "guest workers" experience in Germany. This may have made it difficult to identify changes in labor market outcomes for specific origin groups.

proximity to the inner German border are used as instruments. Results show that almost the entire decline in employment for recruited Turks can be explained by the decline in low-skilled manual employment following the 1993 recession. Younger Turkish cohorts were also particularly sensitive to new immigration. The study suggests that selective return migration may explain up to one third of the differences between Turkish and other immigrants. The latter tended to return to their home countries upon losing their jobs in Germany, while Turks were more likely to stay and apply for unemployment benefits. Survey data from the Socio-Economic Panel (SOEP) suggests that co-ethnic communities, language skills, family structure, and health did not significantly contribute to the differences between Turks and other migrants, after controlling for their allocation to occupations and regions.

Contribution to the literature. First and foremost, this paper contributes to the literature on how external shocks affect the labor market outcomes of immigrants. Previous research has shown that immigrants are more sensitive to business cycle fluctuations than native workers, even within the same skill groups (Barth et al., 2004; Bratsberg et al., 2006; Dustmann et al., 2010). Similarly, they are also more adversely affected by new immigration shocks (LaLonde & Topel, 1991; D'Amuri et al., 2010; Brücker & Jahn, 2011). In contrast to these studies, this paper highlights the significant heterogeneity in the responses to economic shocks among different migrant groups, depending on their career stage and region of origin. It also suggests that differences in selective return migration play an key role in how migrants react to shocks, adding a new aspect to the literature on return migration (Dustmann, 1993; Lubotsky, 2007; Dustmann & Görlach, 2016; Kuhlenkasper & Steinhardt, 2017). In particular, its findings are in line with predictions from a theoretical framework proposed by Adda et al. (2022): With the intention to return to their home country soon, migrants from the recruitment countries invested little in host-country specific capital during the first years in Germany. When return migration turned out to be undesirable for Turks (e.g. because of the political and economic situation in their home country), they performed worse than other migrants who could realize their initial plans.

This study also adds to the understanding of the longer-run impacts of more persistent changes like deindustrialization and increasing returns to skills on immigrant assimilation (Lubotsky, 2011; Reitz, 2001; Moreno-Galbis, Tanguy, Tritah & Laffineur, 2019; Wiedner & Giesecke, 2022). Unlike previous studies that compared different groups of newly arrived immigrants, this study follows the same group of migrants over a long period, revealing that changing economic conditions can harm even those who are established in the labor market. Wiedner & Giesecke (2022) also focus on the long-term trends in the integration of Turks in Germany, but mainly attribute widening labor market gaps to their educational and occupational composition. This study, in contrast, highlights their sensitivity to specific shocks, which explains the sudden timing of the employment drop among Turks, and the reasons why migrants from other recruitment countries did

not face a similar fate. In particular, Wiedner & Giesecke (2022) cannot capture the importance of return migration without panel data. Additionally, this paper presents evidence of negative employment effects of task-biased technical change on older migrants. While recent research has shown that employment losses due to technical change are typically offset by new employment opportunities, even for low-skilled workers (Gregory, Salomons & Zierahn, 2021; Dauth, Findeisen, Suedekum & Woessner, 2021; Battisti, Dustmann & Schönberg, 2022; Moreno-Galbis et al., 2019), this study suggests that specific groups of older, low-skilled migrants may be an important exception.

In a similar setting as this study, Bratsberg et al. (2010) document a decline in employment for labor migrants in Norway who arrived in the early 1970s, which is attributed to an unfavorable allocation into industries and low work incentives for large families in the welfare state. In contrast, this study does not find evidence that family structure or large co-ethnic enclaves significantly contributed to the employment collapse, although these factors may have hindered their language skills and long-term integration prospects (as discussed in Battisti, Peri & Romiti, 2021; Danzer & Yaman, 2013, 2016; Glitz, 2014).

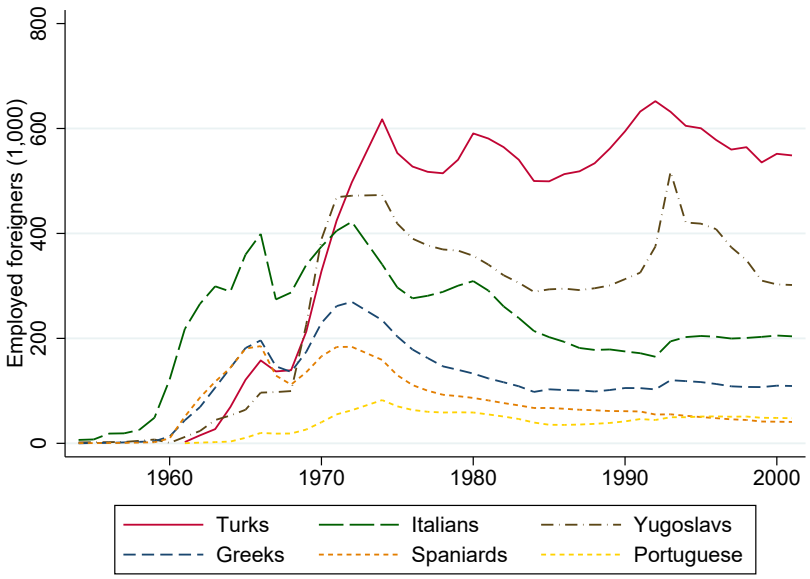
After a brief overview on the historical and institutional background and the data sources, this paper is structured into three main parts. The first part is primarily descriptive and examines the labor market biographies of recruited workers and their families. The second part estimates causal impacts of various economic shocks and changing economic conditions during the 1990s. The third part discusses potential explanations for the higher sensitivity of Turkish immigrants to economic changes compared to other migrants.

4.2 Historical and Institutional Background

During the post-war economic boom, the German industry experienced labor shortages and recruited millions of foreign workers. In response to pressure from employers and origin countries facing high unemployment, the German government signed recruitment treaties with Italy (1955), Spain and Greece (1960), Turkey (1961), Morocco (1963), Portugal (1964), Tunisia (1965), and former Yugoslavia (1968). Between 1955 and 1973, the number of employed foreigners from these origin countries increased from just 10,000 to around 2 million, representing 8.8% of all employees at the time (summarized in Figure 4.2). However, recruitment was stopped permanently in November 1973 due to the first oil crisis. While the overall number of foreign workers began to decline after that date, the non-labor force population increased as more and more guest workers brought their family members to Germany (for more details, see Bauer et al., 2005).

Originally, the recruited workers were intended to be a flexible workforce that could adapt to short-term fluctuations in demand, and were expected to stay only temporarily,

FIGURE 4.2: IMMIGRANTS FROM RECRUITMENT COUNTRIES 1955-2001 (STOCKS)



Notes: Employment subject to social security countributions. Source: Amtliche Nachrichten der Bundesanstalt für Arbeit, several volumes.

as suggested by the term "guest workers".[4] They were granted one-year residence and working permits and were strongly encouraged to return to their home countries after that period. However, firms opposed this "rotation principle" because they had to pay recruitment fees for every new worker and wanted to keep those who had acquired firm-specific knowledge. Therefore, residence permits could be renewed multiple times since 1965. As a result, return migration was substantial during the recruitment period, but much lower than expected by the authorities.

The recruited workers were primarily young men with low levels of formal education who took unskilled manual jobs in agriculture, mining, heavy industry, and manufacturing. Because they were expected to stay only temporarily, little effort was put into their social integration. They were often segregated in the workplace and lived in dedicated group accommodations or specific neighborhoods. Migrant children usually attended separate classes in schools. As a consequence, the Turkish community in Germany remains one of the most segregated migrant groups in Europe until today (Glitz, 2014).

After the recruitment stop, there was an increase in family migration and a decrease

[4] A large fraction of foreign workers were directly recruited by the German Labor Office. On the other side, some workers organized their migration themselves (e.g. through friends or family members that already lived in Germany and provided access to jobs). This was the case for 10% to 60% of new migrants, depending on the year and origin country (Bauer et al., 2005). The Labor office installed recruitment offices in the origin countries and firms could submit contract offers to these offices that then chose suitable candidates. Recruited workers themselves had no influence on their placement and strong incentives to accept a work offer from Germany because they would not receive another one if they rejected it.

in incentives to return to Turkey due to economic and political instability in their origin country.[5] In an effort to restrict new immigration, reduce the movement of foreigners into areas with already large migrant communities, and encourage return migration, the German government implemented a series of policies in the 1980s. One such policy was the "Law to Promote the Willingness of Foreigners to Return Home" ("Gesetz zur Förderung der Rückkehrbereitschaft von Ausländern"), which offered cash incentives to unemployed or laid-off migrants from non-EU countries who agreed to permanently return to their home countries (Bade & Oltmer, 2004; Dustmann et al., 1996). Around 150,000 foreigners, mostly Turks, accepted this offer (corresponding to less than 10% of the Turkish population at the time; Der Spiegel, 1984) This program also aimed to alleviate the burden on the pension insurance system by requiring returning migrants to liquidate their pension accounts, which means that those who returned under this program are not included in the data of this study.

4.3 Data

4.3.1 Data Sources

BASiD. The main analysis of this study is based on the BASiD, a sample of individual pension accounts, provided by the German Pension Insurance, merged with employment biographies from the social security registers, provided by the Institute for Employment Research (IAB). The register data contain day-specific spells on any pension relevant times, including periods of employment and unemployment as well as wages.[6] It combines a set of advantages that make it uniquely suited for the purpose of this study: it consists of an individual panel starting in the 1950s that covers the entire working lives of recruited workers in Germany, including the recruitment period before 1973 that is not covered by other datasets.[7] The data is administratively recorded and has exceptionally high quality, as it serves as the basis for calculating welfare and pension payments. The BASiD also includes information about people who are out of the labor force if they have a pension-relevant status, such as vocational schooling, childcare, caring for elderly people, illness, disability or retirement. Therefore, it is possible to compute employment rates for migrant groups that are similar in size to those in the microcensus, indicating

[5] The period of 1980-2002 was characterized by military coups, frequently changing governments and economic stagnation in Turkey. Apart from this, an armed conflict started in 1984 between the Turkish government and various Kurdish insurgent groups which led to the expulsion of hundreds of thousands of refugees.

[6] Spells of self-employment or as a civil servant are not recorded because these workers are not obliged to pay social security and pension contributions. I drop small numbers of self-employed who voluntarily contribute to the pension insurance as this is potentially a highly selective sub-group.

[7] The use of panel data for studying individual labor market biographies of Turks is a major difference compared to Wiedner & Giesecke (2022), who rely on repeated cross-sections starting only in 1976. Other existing research on the cohort of recruited workers is mainly based on the SOEP and also misses out the initial decades of these migrants in Germany, including Dustmann (1993); Pischke (1992); Licht & Steiner (1994); Schmidt (1997); Constant & Massey (2005); Fertig & Schurer (2007); Danzer & Yaman (2013, 2016). Also beyond Germany, administrative registers (including in the Scandinavian countries) do not start before the 1970s and would not be suitable for a similar analysis.

that they are likely accurate. However, information on region, occupation, industry, and firm characteristics is only available in the social security data starting in 1975.

The BASiD is a 1% random sample of all individuals with an active pension account at the German pension insurance as of December 31, 2007.[8] The sample only covers birth cohorts born in 1940 or earlier, as pension accounts are typically closed at the age of 67. The sample is representative of about 90% of the German population, as most workers (with the exception of self-employed individuals and civil servants) are required by law to be registered with the pension insurance. It includes all migrants who have earned pension entitlements in Germany, regardless of whether they still live in Germany or have returned home.[9] The immigrant status of recruited workers can only be inferred based on their nationality, which is only available starting in 1975. Nevertheless, selective naturalization is not a problem, because changes in citizenship can be directly observed and naturalization was very uncommon for migrants from the recruitment countries, at least until the introduction of a new citizenship law in 2000. Employment and unemployment spells are recorded only for individuals working or living in Germany, but pension receipt data may include individuals residing in other countries.

SOEP. I also report complementary results that are based on the German Socio-Economic Panel (SOEP). This annual panel survey started in 1984 with a representative sample of the West-German population and an additional immigrant sample of households with a household head from the main recruitment countries. Despite much smaller sample size compared to the BASiD, the SOEP questionnaires cover a wide range of individual information, including family and household composition, (self-reported) language skills, social networks and intentions to return to the home country. I use these variables to explore potential mechanisms on why Turkish workers differ so much from other migrants in their labor market outcomes.

BHP. The Establishment History Panel (BHP) is provided by the Institute for Employment Research (IAB). It consists of a random 50% sample of firm establishments on the 30th June of each year and reports detailed information on the firms' employees liable to social security. Because the sample is much larger than the BASiD, I use it to calculate the employment drop during the 1993 recession in occupation group $\times$ labor market region cells (see Section 4.5).

4.3.2 Sample

Guest worker sample. The sample is restricted to male residents of West Germany (excluding Berlin) born in 1940 or later. Females are excluded because they make up a small fraction of the originally recruited workers and because their labor supply tends to vary

[8] The sampling is based on the "Sample of Insured Persons and their Insurance Accounts", ("Versicherungskontenstichprobe (VSKT)"), see Stegmann (2013) for details. Women, foreigners and miners (who have their own independent pension insurance) are oversampled, but sampling weights are provided for 2007.

[9] Non-EU citizens who left Germany under a special scheme in 1983/1984 are a notable exception.

significantly based on their region of origin (Constant et al., 2012). Migrants from the main recruitment countries[10] are identified based on their nationality when they first appear in the data. They are classified into two categories: "recruited workers" are those who were employed in Germany before the recruitment period ended in November 1973 and were 18 years or older at that point. "Later arrivals" are those who started their first job in Germany between November 1973 and December 1987, and are likely to consist mostly of family members of recruited workers. The sample is restricted to migrants who arrived before 1988 to avoid confusion with newer immigrants (mostly from Turkey and Yugoslavia) who came as refugees.

Native comparison sample. As a native comparison group, I use males who never had another nationality than the German. For the analysis of the "recruited workers", I use natives born before November 1955 and thus at least 18 years old when the recruitment stopped. As a comparison group for the "later arrivals" I rely on natives born between November 1955 and December 1969, and who were thus at least 18 in the baseyear 1988.

New immigrant sample. To measure new immigration into West Germany around the fall of the Iron Curtain, I record the inflow of East Germans, ethnic Germans, and foreign migrants. I measure all immigrants in 1993 who first appeared in the BASiD after 1988, and count all employed migrants subject to social security contributions regardless of gender and age. Foreigners are identified based on their first recorded nationality. In contrast to other datasets that only record nationality, such as the SIAB or the microcensus, East Germans and ethnic Germans can be directly identified in the BASiD because pre-migration pension claims were transferred to the West German Pension Insurance (Hirsch, Jahn, Toomet & Hochfellner, 2014; Gürtzgen & Diegmann, 2020).

4.3.3 Outcome variables

I examine three outcome variables: (1) the share of days in employment in a given calendar year, (2) the annual share of days in unemployment, and (3) wages as of June 30th of each year. For the first outcome, workers with a job liable to social security contributions are counted as employed, regardless of whether they work full-time or part-time. I count individuals who are in education (vocational training or schooling) as employed in order to avoid bias in employment rates due to different educational participation among migrants and natives. For the second outcome, unemployment is defined as receiving unemployment benefits or being registered as job-seeking and non-working. For the third outcome, I calculate wages only for full-time workers subject to social security contributions, as the registers do not contain exact information on working hours. To impute top-coded wages, I follow the procedures of Dauth & Eppelsheimer (2020).[11] Wages

[10] Italy, Greece, Yugoslavia, Turkey, Spain, and Portugal

[11] I use only the first imputation step, and skipping the leave-one-out means of establishments due to low observation numbers in the BASiD.

are expressed in 2015 Euros, adjusted for inflation. In addition, I impute inconsistent education entries based on Fitzenberger, Osikominu & Völter (2006).

4.4 The Careers of Recruited Workers and their Families

4.4.1 Labor Market Gaps Compared to Natives

This section provides a descriptive overview of the labor market careers of recruited workers and their family members, with a focus on the collapse of employment rates among Turkish migrants in the early 1990s. Figure 4.3 shows conditional employment, unemployment, and wage gaps between migrant workers and natives, which are calculated as the difference in labor market outcomes between a migrant group and natives with the same age, education, occupation, and industry composition.[12]

In 1975, the conditional employment gaps of recruited workers from all countries, including from Turkey were very similar to those of natives. During the 1980s, the employment differentials between Turks and natives started to widen slowly, but shortly after 1990, this widening accelerated sharply. Within a few years Turkish employment rates dropped from around 5 to more than 20 percentage points for the first generation of recruited workers and from zero to 10 percentage points for those who arrived after the recruitment period ended. (Sub-figures 4.3a and 4.3b). Unconditional gaps, which do not control for education, occupations, and industries, are even larger, reaching up to 30 percentage points (Appendix Figure 4.A2).[13] In contrast, the employment gaps for non-Turkish migrants did not change and remained very small. The drop in employment for Turks was accompanied by a similar increase in unemployment (Sub-figures 4.3c and 4.3d), indicating that it was not driven by migrants exiting the labor force or becoming self-employed. In addition, Sub-figure 4.3e illustrates that recruited workers, and in particular Turks, earned lower wages than natives since the end of the recruitment period, and that the gap widened further during the following years, but without a clear break after 1990. The wage profiles of later-arrived Turks in Sub-figure 4.3f instead closely resembled their employment drop, although the widening of the wage gaps seems to start a few years earlier.

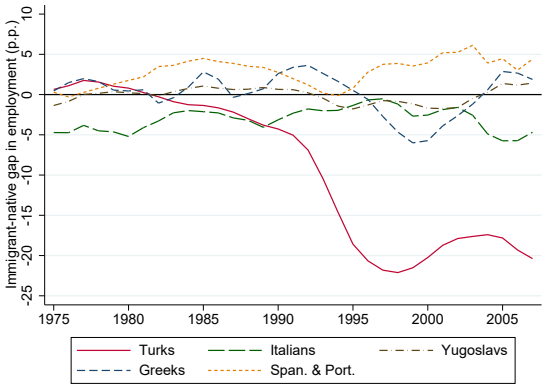
The finding of substantial labor market gaps *conditional* on education, occupations and industry is in stark contrast with previous reasearch which has argued that the poor labor market outcomes of Turkish migrants were mainly due to their unfavorable allocation into declining labor market segments and the educational expansion in the native workforce (Kogan, 2004, 2011; Wiedner & Giesecke, 2022). The breaks in various labor

[12] The calculations for these gaps are detailed in Appendix 4.A.1. For non-employed individuals, I impute occupations and industries from their last job. The figures are based on the BASiD and exclude missing observations, permanent sample dropouts, and retired individuals (those who only receive an old-age pension). Given the age composition of the sample (including only birth cohort 1940 or younger), retirement is only a marginal issue, at least until the year 1998. The patterns and conclusions remain similar when including pensioners and/or missing observation as zeros.

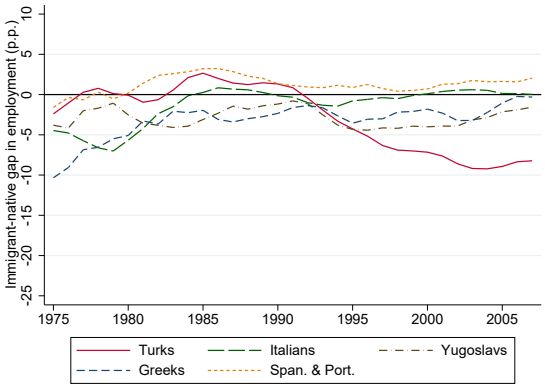
[13] Similar gaps in the microcensus (Figure 3.8 in Chapter 3) suggest that these results are not specific to the BASiD sample, which may have incomplete coverage of self-employed individuals and those out of the labor force. In Section 4.8.2, similar gaps are also reported in the SOEP.

FIGURE 4.3: IMMIGRANT-NATIVE GAPS BY NATIONALITIES AND GENERATIONS

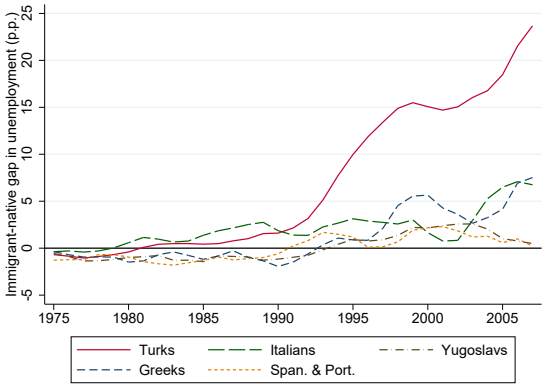
(A) RECRUITED WORKERS: EMPLOYMENT



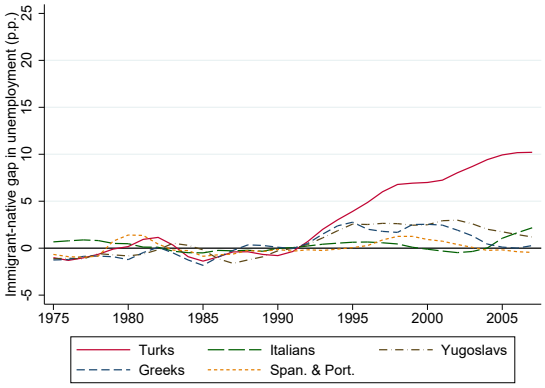
(B) LATER ARRIVALS: EMPLOYMENT



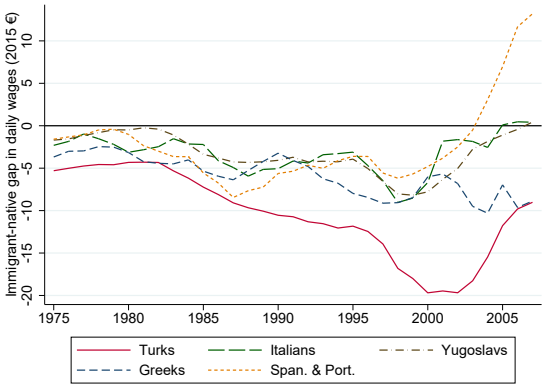
(C) RECRUITED WORKERS: UNEMPLOYMENT



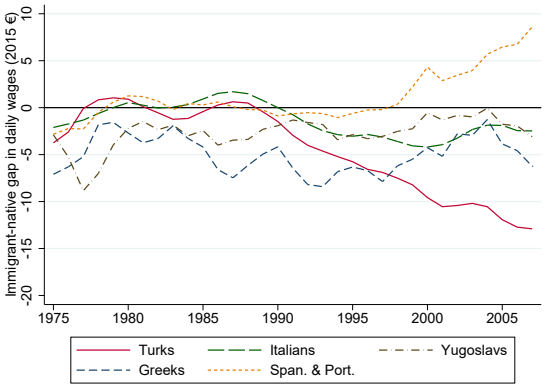
(D) LATER ARRIVALS: UNEMPLOYMENT



(E) RECRUITED WORKERS: DAILY WAGES



(F) LATER ARRIVALS: DAILY WAGES



Notes: Conditional immigrant-native gaps of migrants from the recruitment countries in the BASiD (Section 4.3.2). The comparison is to natives of same the age distribution, education, last occupation and last industry of migrants (Appendix 4.A.1). The figures exclude missing observations, permanent sample dropouts, and retired individuals (those who only receive an old-age pension). "Recruited workers" refers to migrants who started their first job in Germany before the recruitment stop in 1973, and "later arrivals" to migrants woh started their first job between late 1973 and 1987.

market outcomes in the early 1990s instead suggest that there must have been time-specific shocks or changes that affected Turks across arrival cohorts and age groups much more strongly than other migrants from the recruitment countries, conditional on their education and job characteristics. These events resulted in significant employment drops for older Turks who had been subject to the recruitment policy, while later arrivals adjusted not only in employment but also through declining wages, which is consistent with higher wage elasticities among younger workers (Brücker & Jahn, 2011).

4.4.2 Cohort composition

Did the socio-economic background of Turks resemble that of natives and other immigrants before their labor market outcomes started to diverge? Table 4.1 compares the characteristics of Turkish and non-Turkish workers with those of native individuals of similar birth cohorts in the base year 1988. The (extrapolated) observation numbers from 1988 suggests that Turkish individuals made up approximately one-third of the sample of recruited workers, but accounted for more than half of the later arrived migrants. This shows that Turks were particularly likely to bring their family members to Germany after the recruitment policy had stopped (see Bauer et al., 2005). Only 63% of recruited Turks possessed a professional qualification, such as a vocational or university degree, in comparison to 71% of other migrants and 92% of natives. They were also strongly over-represented in simple manual occupations (71% compared to 50% and 19%). Furthermore, Turkish migrants were concentrated in industries such as mining, chemicals, and heavy industry, while other migrants were more likely to be employed in construction and the service sector. Similar patterns of regional distribution can be observed: Turks were concentrated in North-Rhine-Westphalia, which includes the traditional heartlands of German heavy industry in the Ruhr valley that underwent structural changes and economic decline in the second half of the 20th century (see Chapter 2), whereas migrants from other countries were particularly over-represented in the relatively prosperous southern state of Baden-Württemberg.

These findings support previous evidence showing that Turkish immigrants in Germany were characterized by very low levels of education and were placed into unfavorable segments of the labor market (Constant & Massey, 2005; Kogan, 2011; Wiedner & Giesecke, 2022). As evident from Appendix Table 4.A6, these disparities were already present in 1975, suggesting they date back to the recruitment period. However, as discussed in the previous section, the increasing labor market disparities between Turks and other population groups in the 1990s cannot be solely attributed to their educational and occupational composition, but must also stem from a higher vulnerability to certain time-specific events.

4.5 Economic Shocks and Changes in the Early 1990s

This section describes the measurement of changing economic conditions and shocks that took place in West Germany during the early 1990s and provides historical context. They

TABLE 4.1: COMPOSITION OF "GUEST WORKER" COHORTS (%, YEAR 1988)

	Natives	Turks		Non-Turks	
		Arrived ≤1973	Arrived 1973-87	Arrived ≤1973	Arrived 1973-87
Age groups					
18-24	23.25	0	44.97	0	30.77
25-39	53.30	15.73	51.16	26.12	58.66
40-48	23.45	84.27	3.87	73.88	10.57
Education					
Professional qualification	92.13	62.95	71.06	77.84	78.65
Occupation groups					
Simple manual	19.11	71.28	52.15	49.56	36.01
Qualified manual	31.52	15.21	22.55	28.92	29.62
Simple services	15.55	10.24	15.80	16.70	19.36
Qualified services	33.82	3.27	9.49	4.82	15.01
Industries					
Agric., mining, quarr.	5.26	12.59	7.29	4.82	2.88
Chemistry, metal prod.	11.08	26.46	20.71	18.09	14.29
Mech. & electr. engineering	19.91	26.47	21.53	24.32	20.87
Other manufacturing	12.77	11.93	15.10	14.25	13.46
Construction	10.55	9.78	7.01	17.57	11.44
Services	40.43	12.78	28.35	20.95	37.05
Regions					
Northern Germany	20.77	14.96	15.03	10.53	8.97
North Rhine-Westphalia	28.86	39.33	32.05	26.79	27.96
Hesse, RLP, Saarland	15.13	14.53	15.24	15.99	18.87
Baden-Württemberg	16.39	18.03	20.60	27.91	29.98
Bavaria	18.85	13.14	17.08	18.78	14.22
Observations (extrapolated)	7,621,245	95,551	288,572	174,531	276,947
Observations (unweighted)	43,251	905	3,907	1,214	3,471

Notes: Males in the BASiD born between 1940 and 1969. Age groups, education and observation numbers are shown for all individuals in the sample; occupations, industries and regions are conditional on employment. Mechanical and electrical engineering include the automotive industry. Simple services include simple personal services and simple commercial and administrative occupations; Qualified services include technical and engineering occupations, qualified personal services, professionals and managers, and qualified commercial administrative occupations (See Appendix Table 4.A4). Northern Germany includes Schleswig-Holstein, Hamburg, Bremen and Lower Saxony. RLP stands for Rhineland-Palatinate.By composition of the sample, the oldest possible age in the year 1988 is 48 years.

include immigration, the employment drop during the 1993 recession, and task-biased technical change. Previous studies have shown that these shocks affected regions very differently and have used regional variation to estimate their effects (Glitz, 2012; Amior & Stuhler, 2022; Yagan, 2019). However, a purely spatial approach may not account for the fact that these economic shocks and changes may have disproportionately affected specific labor market segments where many migrants were employed, as previously discussed, as shown in the previous section. For this reason, I will define the labor market shocks by cells of labor market regions interacted with occupation groups. Specifically, I distinguish 203 West German labor market regions[14] with an average population of approximately 325,000 inhabitants, excluding Berlin, and 8 broad occupation groups (Appendix table 4.A4). Task-biased technical change, which I cannot directly measure at a regional level, is defined at the level of 176 occupations (Maier, 2021).

4.5.1 Immigration

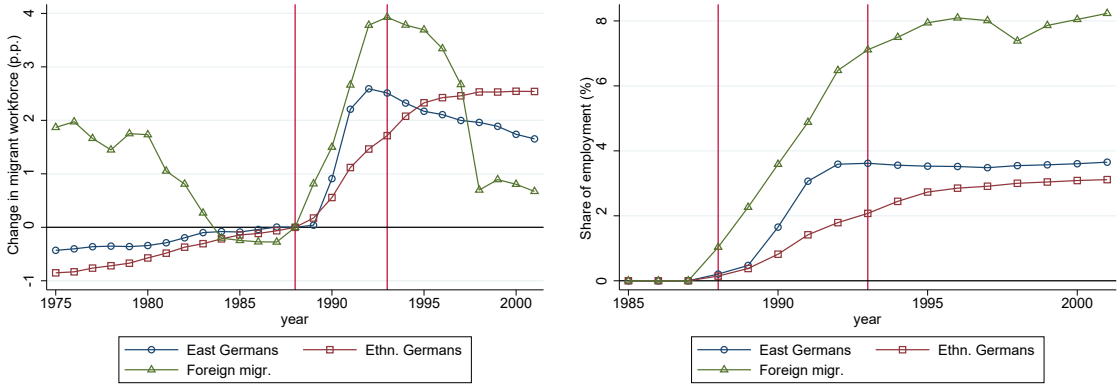
I examine three large-scale immigration events that occurred around 1990. The first event was the influx of East German workers to the West German labor market following the reunification of Germany in 1990 (Fuchs-Schündeln & Schündeln, 2009; Prantl & Spitz-Oener, 2020). Prior to the collapse of the Berlin Wall in 1989, it had been almost impossible for residents of East Germany to migrate to the West. However, the sudden end of the East-West divide led to a significant wave of German-German migration. The West offered much better employment and income prospects than the former East Germany, which was undergoing a difficult economic transition. As a result, over one million East Germans moved to West Germany between 1989 and 1991, with a disproportionately high number of young, highly educated, and female workers. East Germans were distinct from other migrants in that they spoke German as their first language, had gone through a very similar educational systems as the West Germans, and had their educational degrees recognized in both parts of the country.

The second group of migrants were ethnic Germans from Central and Eastern Europe (Glitz, 2012; Hirsch et al., 2014; Piopiunik & Ruhose, 2017). These people were of German descent, but had remained in Eastern European countries after the expulsion of the German population following World War II. There, they often faced oppression, so that the Federal Republic of Germany established a policy to allow those, who could prove their German ancestry, to immigrate and become citizens. With the end of the Cold War, travel restrictions in Central and Eastern Europe were lifted, leading to an increased influx of ethnic Germans since 1988. Most ethnic Germans came together with their families from the territories of the former Soviet Union, Poland, or Romania. Some of these migrants still spoke German and had preserved a cultural identity, but the majority had no cultural ties to Germany anymore.

[14] Defined based on actual commuter flows by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

FIGURE 4.4: IMMIGRANT SHARES IN EMPLOYMENT

(A) CHANGE RELATIVE TO 1988 (B) SHARE OF NEWLY ARRIVED IMMIGRANTS



Notes: Shares of migrants in total employment subject to social security contributions in the BASiD (including all employees regardless of age and gender). Sub-figure (a) shows the change in the migrant shares in total employment relative to the base year 1988. Sub-figure (b) shows the shares of migrants that newly appeared in the BASiD since 1988.

The third immigration event around 1990 was the influx of foreigners, with immigrants from Central and Eastern Europe who did not possess German citizenship representing the largest group (Amior & Stuhler, 2022). This included various forms of temporary migration such as seasonal workers and cross-border commuters (Dustmann et al., 2017). There was also a significant increase in humanitarian immigration due to the Yugoslav War and the Kurdish-Turkish conflict. However, Germany's asylum policy at the time was relatively strict, which led to many of these refugees returning to their home countries once the conflicts ended.

Sub-figure 4.4a shows that the shares of these three migrant groups in West German employment increased significantly between the base year 1988 and 1993. The share of foreign migrants in the workforce increased by nearly 4 percentage points, the share of East Germans by roughly 2.5 percentage points and the share of ethnic Germans by 1.8 percentage points.[15] Additionally, Sub-figure 4.4b plots only the employment shares of new arrivals, meaning migrants that have arrived since 1988. By 1993, an impressive 12% of employees in West Germany were migrants who had arrived in the previous five years.[16] Furthermore, these different immigrant groups were employed in quite different occupation groups, as shown in Table 4.2. East Germans worked in very different occupations as incumbent migrants from the recruitment countries and mostly in the service sector, as they were the only migrant group with German as their native language. Only 18.1% of East Germans worked in simple manual occupations compared to 56.0% among recruited workers and 43.3% among later arrivals. Ethnic Germans, on the other hand,

[15] The decline in foreign employment after 1995 is mainly driven by the return of Yugoslav refugees as well as the employment collapse of earlier Turkish cohorts.

[16] Because of the sampling of the BASiD, these migrant shares are probably larger than migrant shares in the entire workforce (Amior & Stuhler, 2022 report 6 percent recently arrived foreign migrants in 1998 based on the SIAB, as compared to about 8 percent in the BASiD). This is because the BASiD only includes birth cohorts 1940 or younger that contain relatively high shares of immigrants and omits older cohorts that consist mainly of natives. However within the age groups of my sample, these shares are probably accurate.

TABLE 4.2: OCCUPATIONAL ALLOCATION OF NEWLY ARRIVED MIGRANT GROUPS (%)

Occupation group	Natives	New immigrants			"Guest workers"	
		East Germans	Ethnic Germans	Foreign migrants	Recruited workers	Later arrivals
Simple Manual	14.33	18.07	35.54	27.65	55.96	43.27
Qualified Manual	17.73	21.40	22.01	18.92	23.50	21.84
Techn. & Engineer	8.95	7.93	6.16	4.29	1.75	4.90
Simple Services	21.49	27.72	22.15	28.79	15.68	19.91
Qualified Services	27.76	16.78	8.24	13.94	2.35	7.00
Prof. & Managers	9.74	8.08	5.89	6.41	1.04	3.08
Obs. (extrapol.)	12,239,421	595,005	341,148	1,169,388	216,248	460,968
Obs. (unweighted)	74,009	3,624	2,155	21,676	1,654	5,941

Notes: Employment liable to social security contributions measured in 1993 (Shares in %). "New migrants" include only migrants who have arrived since 1988. The occupational shares for new immigrants refer to all individuals (regardless of their gender) that were employed in 1993 and were first recorded in the dataset since 1988. The occupation shares for "Guest workers" refer to the main sample of this paper (only males arrived before 1988). Simple services include simple personal services and simple commercial and administrative occupations; Qualified services include qualified personal services and qualified commercial administrative occupations (See Appendix Table 4.A4).

were the immigrant group that was most similar to incumbent migrants from the recruitment states, with 35.5% working in simple manual occupations. New foreign migrants, the largest and potentially most relevant migrant group, were considerably less likely to work in these occupations (27.7%) than ethnic Germans and incumbent "guest workers" and tended to cluster in simple services. Given the occupational allocation of these groups, it is likely that the "guest worker" cohorts would be more adversely affected by the arrival of ethnic Germans and new foreign immigrants than by East Germans.

I measure new immigration for each of the three groups separately in the BASiD for the year 1993 (for ethnic Germans in the year 1996) as:

$$shock_{ro}^{immigration} = \frac{m_{ro,1993}^{newly\ arrived}}{n_{ro,1988}} \tag{4.1}$$

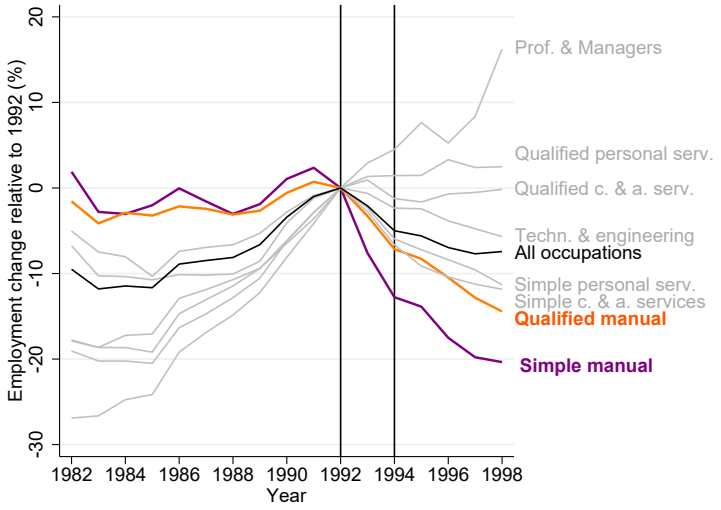
where $m_{ro,1993}^{newly\ arrived}$ is the number of migrants employed subject to social security contributions who have arrived since 1988, measured in 1993 in labor market region r and occupation group o. $n_{ro,1988}$ denotes the total number of workers subject to social security contributions in region r and o in the base year 1988. The immigration shocks are thus measured as the share of immigrants who arrived between 1988 and 1993 in total employment.

4.5.2 The 1993 employment drop

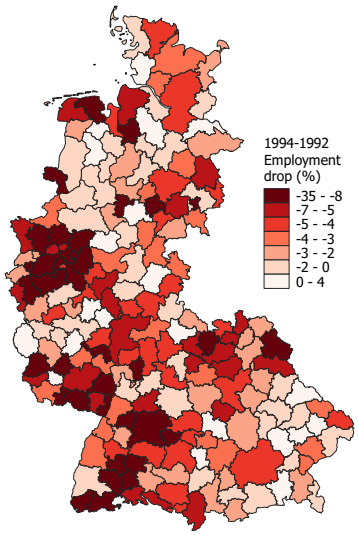
In 1993, Germany's economy was impacted by a recession due to rising government debt resulting from reunification, high inflation, and declining exports. Over the following decade, there was no significant recovery from this recession, as economic growth remained sluggish and unemployment rates in West Germany continued to rise, reaching

FIGURE 4.5: 1993 RECESSION SHOCK

(A) OCCUPATIONAL TIME TRENDS



(B) REGIONAL VARIATION



Notes: Total employment subject to social security contributions in West German labor markets, excluding Berlin. "c. & a. services" refers to "commercial and administrative services". See Appendix Table 4.A4 for a definition of the occupation groups. Source: BHP.

10.8% in 1997 and remaining on a similar level until 2006, compared to 6.2% in 1991 (Dustmann, Fitzenberger, Schönberg & Spitz-Oener, 2014). My aim is to create a measure over a very short time span that mainly captures the immediate demand shock induced by the 1993 recession, minimizing the influence of secular trends. To achieve this, I calculate the decrease in employment in the BHP between mid-1992 and mid-1994 in each region and occupation-group cell, following a similar approach as Yagan (2019).

$$shock_{ro}^{recession} = \frac{n_{ro,1994} - n_{ro,1992}}{n_{ro,1992}} \tag{4.2}$$

where $n_{ro,1994}$ is the number of employed persons subject to social security contributions in region r, occupation group o and the year 1994. This shock can be interpreted as the employment drop between 1994 and 1992 in an region $\times$ occupation group cell relative to 1992. A reduction in the *absolute* number of available jobs is likely to have a significant impact on incumbent workers, and I believe that this measure effectively captures the evolution of employment opportunities in specific labor market segments around 1993.

Figure 4.5a shows that the average employment in West Germany declined by 5 percentage points between 1992 and 1994. The greatest decline of close to 13 percentage points occurred in simple manual occupations, meaning that about one in eight jobs in these occupations disappeared within just two years. Although the timing of the employment drop in manual occupations generally corresponds with the growing labor market gaps between Turkish migrants and natives illustrated in Figure 4.3, it probably does not fully explain the deterioration of their labor market integration: The employment rates of recruited workers from Turkey were already declining prior to 1993, suggesting that

long-term trends also played a role. Additionally, the wage divergence among later arrivals had already started around 1990, too early for the 1993 recession.

Traditional industrial regions, in particular the Ruhr valley were disproportionately affected by this employment drop, as as shown in Figure 4.5b. This suggests that the short-run employment drop around the 1993 recession might correlate with structural transformation and the decline of early industrializing regions, as discussed in Chapter 2. I cannot exclude that the recession might have exacerbated changes that were already underway. For this reason, I will also control for a longer-run measure of task-biased technical change that is presented in the following section.

I am less concerned that the 1993 recession shock, as measured in this study, is strongly distorted by new immigration. New immigration had already reached its peak by mid-1992 (Figure 4.4), and new immigrants were particularly likely to work in those occupations that were most affected by the 1993 employment drop. As a result, if anything, new immigration should bias the recession shock towards zero.

4.5.3 Task-Biased Technical Change

The 1990s marked a period of significant structural transformations in the German labor market that was characterized by the gradual decline of routine-intense tasks and a shift towards more interactive tasks (Spitz-Oener, 2006). In addition to the short-run employment drop during the 1993 recession that was probably mainly triggered by an economic downturn and foreign trade shocks, I also want to investigate the effects of task-biased technical change on the labor market integration of Turkish migrants. Task-biased change reflects longer-run transformations that take more time to materialize and might affect specific occupations within the same broad occupation group very differently. Even within the broad group of simple manual occupations, Turks might have been working in those jobs that were most susceptible to automation or physically most demanding. For that purpose, I measure change in the demand for a particular individual's skill set over the period studied, using a novel dataset on the task-content of 176 occupations over the period 1973-2011 based on the German microcensus (Maier, 2021). For each of 176 occupations q, I predict a "task-trend" using the equation:

$$shock_q^{task\text{-}trend} = 100 \left(\left(\sum_{k=1}^{8} s_{q,1988}^k \left(\frac{s_{1998}^k}{s_{1988}^k} \right) \right) - 1 \right) \tag{4.3}$$

where $s_{q,1988}^k$ is the share of task k in occupation q in the year 1988 and $\frac{s_{1998}^k}{s_{1988}^k}$ the average growth of the share of task k between the years 1988 and 1998 across all occupations. Thus, this "task-trend" is a weighted sum of the time trends in economy-wide demand for the task set of a specific occupation in the base year 1988. As examples, the particularly unfavorable "task-trend" for concrete builders and brick layers of -24.6 means that demand for the tasks that were used in in this occupation in 1988 declined by 24.6% until 2001, which is mainly driven by a decline in the manual task "extraction and manufacturing", but also "repairing and mending". Teachers, on the other hand, have experienced

a positive "task-trend" of 54.5%, mainly because the task "educating, training, etc." has gained massive importance during the same time period.

4.6 Empirical Approach

4.6.1 Empirical model

For the main analysis, I restrict the sample to a balanced panel of natives and Turks who arrived to Germany before 1988, excluding all other immigrants. This is to prevent changes in cohort composition over time from affecting the results. The panel only includes individuals who were non-missing and not retired in 1988 and still the same in 1998. I adopt an empirical design that losely follows earlier work using longitudinal individual-level data to estimate the impacts of labor market shocks over several years (Autor, Dorn, Hanson & Song, 2014; Yagan, 2019). For the years 1985-1998, I estimate a regression of the form:

$$y_{irqt} = \sum_{t=1985}^{1998} \sum_{s=1}^{5} (\beta^{st} shock^{s}_{r,o(q)} \times D^{I} \times D^{t}) + \phi X_{it} + \pi_{i} + \pi_{r,o(q),t} + \pi_{qt} + \epsilon_{irqt} \qquad (4.4)$$

where y_{irqt} is a labor market outcome of individual i in region r with occupation q at time t. Both q and r are kept constant in the base year 1988, before the economic shocks occur. The regression includes the five time-invariant shocks s as defined in the previous section, measured on the level of broad occupation groups o $\times$ regions r or on the level of occupations q (see previous section). Because the purpose is to estimate the relative importance of the different shocks, they are all included simultaneously. They are each interacted with a full set of dummy variables for the years 1985-1998 (D_t, omitting 1988 as the base year) and with D^I, an indicator that takes the value one for a specific immigrant group, in this study usually Turkish migrants. Fixed effects for occupation group $\times$ regions $\times$ time ($\pi_{r,o(q),t}$) and occupations $\times$ time (π_{qt}) capture the effects of any observed and unobserved time-specific shocks that hit occupations or occupation group $\times$ region cells. As these fixed effects absorb all variation on these levels for natives, the coefficients β^{st} capture the difference in effects between immigrants and natives.[17] X_i is a vector of control variables that includes age-dummies and dummies for three education levels, each interacted with year dummies, capturing over-time changes in returns to education, age-earning profiles or retirement. On top of this, individual fixed effects π_i control for any observable and unobservable time-invariant differences between individuals, keeping only within-individual, over-time variation. Summarizing, I only exploit variation within the same individual over time and abstract from any time-specific shocks to regions or occupation that affect immigrants and natives equally. Any differences in the effects of shocks between immigrants and native will be captured by β^{st}.

[17] The results are overall robust to excluding fixed effects ($\pi_{r,o(q),t}$) and (π_{qt}). I interpret this as an indication that the widening immigrant-native differences cannot be explained solely by a different allocation of immigrants to regions and occupations.

The shocks exploit both, spatial and occupational variation. Therefore the coefficients β^{Ist} identify the *relative* effect of the shocks on one occupation group compared to another, rather than the *total* effect (described as a "mixed approach" by Dustmann et al., 2016). In particular, I am only capturing direct competition between incumbent workers and new immigration into the same occupation-region-cell, and not spill-over effects of new immigration into other cells. In the case of this study, this is probably a lesser concern than in other contexts, because only spill-over effects that differ between incumbent native and immigrant workers are missed.

My overall goal is to estimate, how much of the observed gap between immigrants and natives can be either explained (1) by different exposure of immigrant groups to each shock s compared to natives or (2) by different sensitivity to the shock, given a certain exposure. For that purpose I perform Oaxaca-Blinder-decompositions of the form:

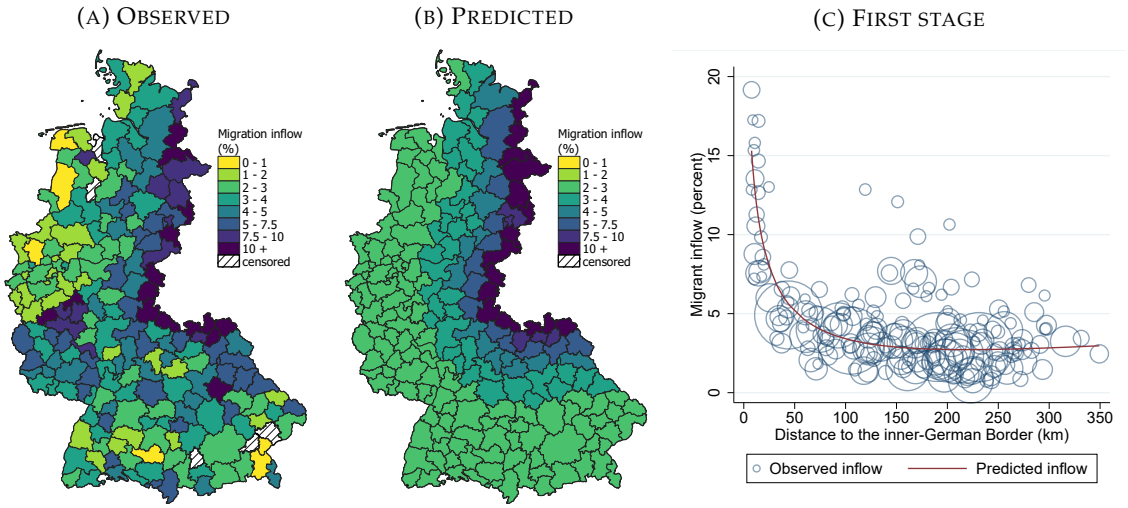
$$\begin{aligned} \widehat{gap}^{st} &= \hat{\beta}^{st}\overline{shock}^{st}_{(I=1)} \\ &= \underbrace{\hat{\beta}^{st}(\overline{shock}^{st}_{(I=1)} - \overline{shock}^{st}_{(N=1)})}_{\text{Difference in exposure}} + \underbrace{\hat{\beta}^{st}\overline{shock}^{st}_{(N=1)}}_{\text{Difference in coefficients}} \end{aligned} \tag{4.5}$$

where $\hat{\beta}^{st}$ is estimated by equation (4.4) and $\overline{shock}^{s}_{(I=1)}$ is the average exposure of immigrants to shock s and $\overline{shock}^{s}_{(N=1)}$ the average exposure of natives. The first component captures whether immigrants on average lived in region-occupation cells that were stronger affected by a given shock s than natives ("Difference in exposure") and the second component whether immigrants were differently affected by a shock if they were treated the same as natives ("Difference in coefficients").

4.6.2 Identification

For β^{st} to capture causal effects, the labor market shocks must be orthogonal to other time-specific events that affect immigrants differently than natives, conditional on control variables and fixed effects. For instance, this identifying assumption might be violated if new immigrants would self-select into regions or occupations that are subject to simultaneous demand shocks that also affect incumbent immigrants differently than natives. As an example, a local demand shock that decreases job opportunities without German language requirements might simultaneously worsen the relative labor market chances of incumbent migrants and reduce new immigration inflows. Similarly, shocks in import competition may correlate not only with the 1993 recession, but also have a greater impact on foreign-born workers than on natives, because their skills are more substitutable to foreign imports. For these reasons I rely on an instrumental variables approach, instrumenting some of the shocks with predictions based on past economic structures or geography. The following paragraphs explain the instruments. Appendix-section 4.A.2 presents the results from the first-stage regressions, confirming that all instruments are strong and function as expected.

FIGURE 4.6: IMMIGRATION OF EAST GERMANS



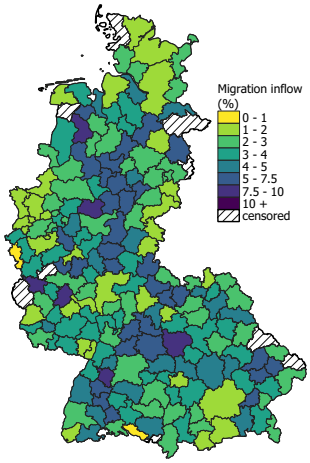
Notes: The maps show the share of East German immigrants with first appearance in West German labor markets between 1988 and 1993 in total employment subject to social security contributions. To increase observation numbers, these and the following maps include immigrants who arrived between the years 1988 and 1993 pooled over the period 1988-2001 and not only in the year 1993. This is only done for visualization and does not affect the shocks used in the actual analysis.

East Germans. Already a visual inspection of the inflow of East Germans to West German labor markets reveals that distance to the inner-German border is a very good predictor of the settlement of East Germans after the fall of the Berlin Wall (Figure 4.6 and see also Amior & Stuhler, 2022). For that reason, I predict the immigration of East Germans as:

$$\widehat{shock}_{ro}^{\,East\ Germans} = \frac{\hat{m}_{r,1993}^{newly\ arrived} s_{go,1993}}{n_{ro,1988}} \tag{4.6}$$

where $\hat{m}_{r,1993}^{newly\ arrived}$ is the predicted population of East Germans in region r only based on the log distance to the inner-German border and the log distance squared (as depicted in Sub-figure 4.6c). $s_{go,1993}$ denotes Germany-wide employment of East Germans in occupation group o in the year 1993, including individuals who stayed in East Germany as well as those who moved to the West, i.e. the migration potential, and $n_{ro,1988}$ the total number of workers employed in region r and occupation o in base year 1988. Following the approach used by Prantl & Spitz-Oener (2020), I predict the occupational composition of East-West migrants with the migration potential. Unlike actual migration, the migration potential cannot be affected by other simultaneous short-run labor market shocks, assuming that workers cannot easily switch between broad occupation groups. However, the pure distance to the former GDR might have affected not only labor supply through immigration, but also demand, for example, through improved market access to Eastern Germany. Therefore, the "East German shock" should be interpreted as the labor supply shock from East German migrants plus eventual other distance-related effects of German reunification.

FIGURE 4.7: IMMIGRATION OF ETHNIC GERMANS (OBSERVED)



Notes: The maps show the share of Foreign immigrants with first appearance in West German labor markets between 1988 and 1993 in total employment subject to social security contributions.

Ethnic Germans. Ethnic Germans were not allowed to chose their place of residence freely and were allocated to regions based on a dispersal policy. For that reason, I will not use an instrument for the inflow of ethnic Germans as depicted in Figure 4.7 and will assume that it was exogenous, as previous studies have also done (Glitz, 2012; Piopiunik & Ruhose, 2017).[18] Indeed, Figure 4.7 reveals substantial variation across regions, but no obvious clustering in certain areas. In order to address remaining endogeneity concerns, I pay particular attention to pre-treatment trends for the ethnic-German-migration-shock in the event study graphs and I assign ethnic Germans to the region in which they first appear in the data. By doing so, I increase the likelihood that the actual location has been assigned by the dispersal policy and not by subsequent internal migration.

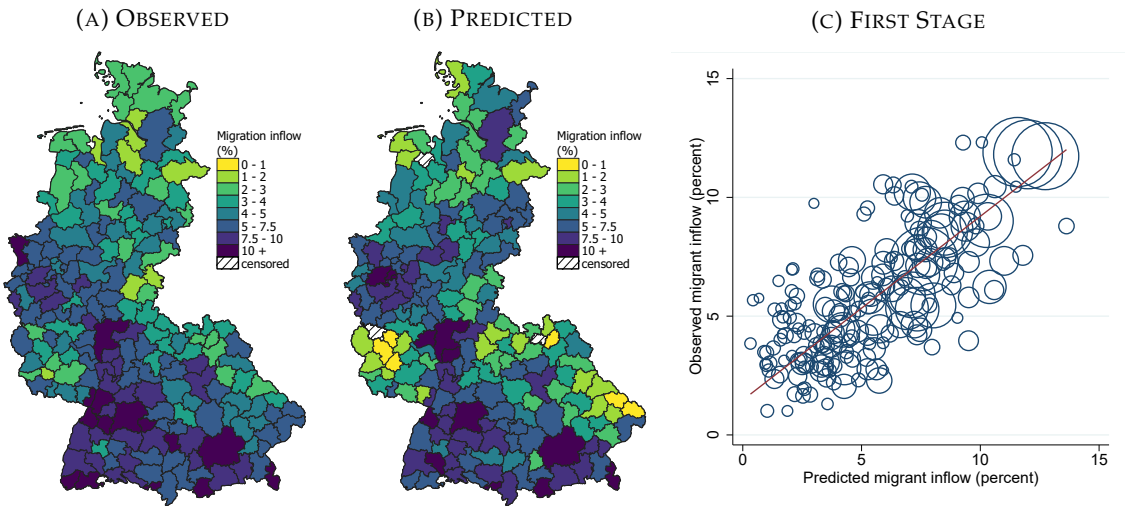
Foreign migrants. I use the spatial distribution of past immigrant settlements as a predictor of the distribution of foreign migrants as it is done frequently in the literature (Jaeger, Ruist & Stuhler, 2018). By doing so, I ensure that local and occupational demand shocks do not confound my measure of immigration. Specifically, I predict the local change in foreign shares based on the distribution of foreign nationals at baseline (following Card, 2001; Amior & Stuhler, 2022):

$$\widehat{shock}_{ro}^{\,foreign\ migrants} = \frac{\sum_n s_{nr,1980}\ s_{no,1980}\ m_{n,1993}^{newly\ arrived}}{n_{ro,1988}} \tag{4.7}$$

where $s_{nr,1980}$ is the share of immigrants of nationality n who lived in region r in 1980, $s_{no,1980}$ is the share of immigrants of nationality n who worked in occupation o in 1980 and $m_{n,1993}^{newly\ arrived}$ the Germany-wide immigrants of nationality n in 1993 who have arrived since 1988. Again, $n_{ro,1988}$ denotes the total number of workers employed in region r and

[18] The dispersal policy was strictly enforced only since 1996 and for this reason, the mentioned studies only use inflows since 1996. However, post-1996 arrivals are unlikely to have had an important impact on the the employment collapse of Turks that already started earlier.

FIGURE 4.8: IMMIGRATION OF FOREIGNERS



Notes: The maps show the share of Foreign immigrants with first appearance in West German labor markets between 1988 and 1993 in total employment subject to social security contributions.

occupation o in base year 1988. Sub-figure 4.8a indicates that the newly arrived immigrants clustered in the main industrial and urban centers of West Germany, in particular the Rhein-Ruhr and Rhein-Main areas, in Baden-Württemberg and around Munich. Already a visual comparison of the actual observed and predicted immigration suggests a very strong first stage (Sub-figures 4.8a-4.8c).

1993 employment drop. I predict the employment drop during the 1993 recession in region $\times$ occupation-groups cells based on the regional economic structure in 1980 and nationwide occupational trends. Specifically, I calculate:

$$\widehat{shock}_{ro}^{recession} = \frac{s_{ro,1980}\left(n_{no,1994} - n_{no,1992}\right)}{n_{ro,1992}} \tag{4.8}$$

where $s_{ro,1980}$ is the share of employment in occupation group o in region r in total West-German employment in that occupation group. This share is multiplied by the total, West-Germany-wide change in employment in that occupation group between 1994 and 1992, $n_{no,1994} - n_{no,1992}$.

Task-biased technical change. Task-biased technical change is defined as a prediction based on the task-content of occupations at baseline and nationwide task trends. As such, it abstracts from any specific regional and occupational shocks that occurred after the base year of 1988 and there is not need for an instrument.

4.7 What Explains the Labor Market Gaps of Turks?

In this section, I present the results of Oaxaca-Blinder decompositions, according to equations (4.4) and (4.5). They are based on 2SLS estimates at the individual level, instrumenting foreign and East German immigration as well as the 1993 employment drop as outlined in Section 4.6.2.[19] When interpreting these results, it is important to consider that they only reflect the differences between migrants and native workers and not the *overall* impact of shocks on incumbent workers. Appendix Table 4.A7 compares the results to OLS and reduced form estimates for the year 1998. The results are similar regardless of the estimation type. For comparison, Appendix Table 4.A8 also shows corresponding results for non-Turkish migrants.

4.7.1 Employment

Three results from the decompositions of the Turks' employment gaps in Figures 4.9 and 4.10 stand out: First, the employment drop during the 1993 recession was the primary cause of the growing employment gap between Turkish immigrants and native workers after 1992. In comparison, the impact of the task-trend and immigration shocks was minor. The gap that can be attributed to this employment drop (represented by the blue solid line in Sub-figures 4.9a and 4.10a) is about 25 percentage points for recruited workers and about 10 percentage points for later arrivals, which is a similar magnitude as the observed overall gaps in Figure 4.3. As pointed out earlier, this decrease in employment opportunities might reflect not only the recession, but also longer-term trends such as the decade-long crisis in the German labor market around the millenium change, structural transformations, and deindustrialization that were accelerated by the recession. This is likely the reason why the predicted employment gaps for older Turks in Sub-figure 4.9a already exhibit a downward trend prior to 1993. Similarly, the null-effects for the task-trend in Sub-figures 4.9b and 4.10b do not imply that task-biased technical change did not affect the employment chances of Turks, but might result from the correlation between the 1993 employment drop and the task trend.[20] They rather highlight that the immediate regional employment losses had a greater impact on Turks' employment chances than the gradual changes in demand for certain tasks within specific occupations. These findings align with previous research, which found that immigrants' employment is more susceptible to fluctuations in the business cycle than that of natives (Bratsberg et al., 2006; Dustmann et al., 2010).

[19] When interpreting the results, two points should be kept in mind: First, these IV estimates are local average treatment effects ("LATE") and capture the effects of *compliers*, in the case of this study immigrants who settled according to the instruments, primarily foreigners who moved into pre-existing communities and East Germans who tended to settle close to the inner-German border or regions, where the occupation group-specific 1993 employment drop was similar to nation-wide average drops in the respective occupation group. Second, these estimates are based on individual level data and only capture changes within individuals over time, due to the use of individual fixed effects. Therefore, they cannot be directly compared to studies that focus on aggregate regional levels, such as those by Glitz (2012) and Dustmann et al. (2017).

[20] When omitting the 1993 employment drop from the regressions, the task-trend becomes negative and statistically significant.

FIGURE 4.9: DECOMPOSITION OF IMMIGRANT-NATIVE EMPLOYMENT GAPS: RECRUITED WORKERS FROM TURKEY

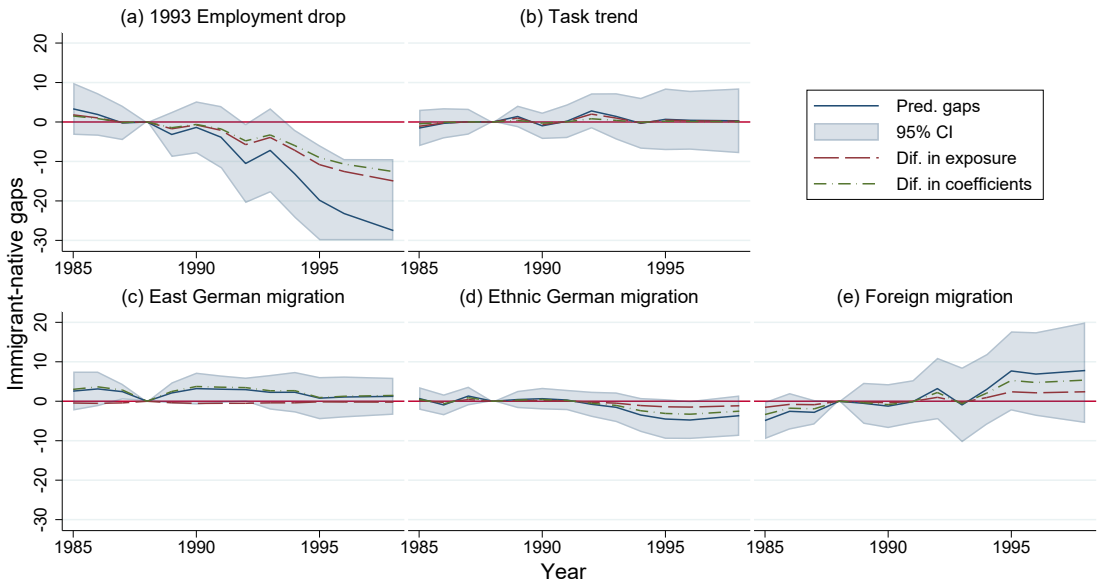
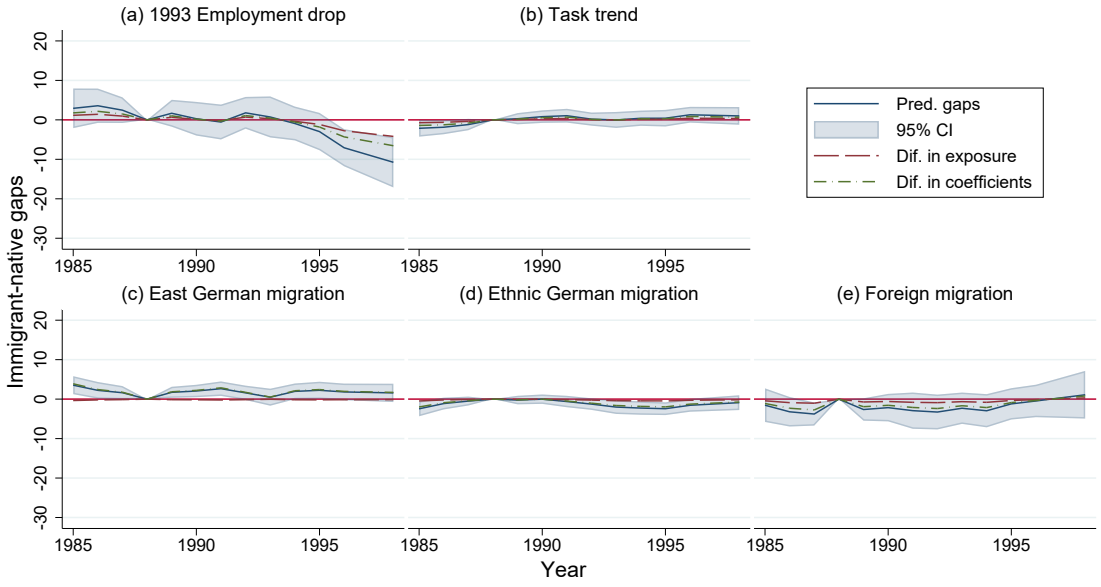


FIGURE 4.10: DECOMPOSITION OF IMMIGRANT-NATIVE EMPLOYMENT GAPS: LATER ARRIVALS FROM TURKEY



Notes: Oaxaca-Blinder decompositions according to equations (4.4) and (4.5), including individual fixed effects, occupation group × region × time fixed effects and occupation × time fixed effects. The estimation sample includes natives and Turks, covering the years 1985-1998. IV estimates, instrumenting foreign and East German immigration as well as the recession shock, as outlined in Section 4.6.2. Standard Errors clustered on the occupation group × region level.

Second, both the initially recruited Turkish workers and later arrivals were more *sensitive* to the recession-induced employment drop than native workers ("difference in coefficients", green dotted lines in Sub-figures 4.9a and 4.10a). However, the older, initially recruited group of Turkish workers experienced a greater overall decrease in employment mainly due to their *allocation* into unfavorable labor market segments ("difference in exposure", red dashed lines). This confirms that the older, recruited workers were placed in regions and occupations that were highly affected by the 1993 employment losses, hindering their integration into the labor market, as discussed in previous studies by Wiedner & Giesecke (2022); Kogan (2011); Constant & Massey (2005). In contrast to these studies, the results of this paper highlight that compositional differences cannot solely explain the widening labor market gaps of Turkish workers. This might be related to the structural difficulties that Turkish migrants face in finding employment after unemployment (Kogan, 2004; Uhlendorff & Zimmermann, 2014; Illing & Koch, 2021).

The third finding is that new immigration had only a minor impact on the employment decline of Turkish immigrants compared to natives (Sub-figures 4.9c-d and 4.10c-d). The effects of the influx of East Germans after the fall of the Berlin Wall is overall positive. This might be due to the fact that East Germans were channeled into different labor market segments, particularly the service sector, and were more likely to be complements rather than competitors for Turkish immigrants (see Table 4.2). In addition, the inflow of East Germans might also reflect other distance-based effects of German reunification that were beneficial to incumbent migrants, such as improved market access (Zierahn, 2012). The influx of ethnic German immigrants had a negative effect on the employment of Turkish immigrants. The negative effect was larger for recruited workers (up to -4.8 percentage points) compared to later arrivals (up to -2.4 percentage points) and almost statistically significant at the 5% level. This result aligns with ethnic Germans being the migrant group that was most likely to end up in simple manual occupations and to compete with Turkish immigrants (see Table 4.2) and complements findings by Glitz (2012). The effect of foreign immigration is close to zero for recruited workers and slightly negative, albeit not statistically significant for later arrivals, at least around the peak of new immigration in 1991/1992.[21] This result contradicts the findings of D'Amuri et al. (2010), who attributed the increase in unemployment among incumbent migrants in Germany during the 1990s mainly to rising competition from new immigrants.

4.7.2 Wages

As depicted in Figure 4.12, the widening wage gap between more recent Turkish immigrants and similar natives during the early 1990s is in the very short-term primarily

[21] The employment gaps of recruited workers explained by new foreign migration turn positive around the year 1995, about 4 years later. This finding is puzzling, but should be interpreted as *individual* effects of new immigration. As Dustmann et al. (2017) illustrate, individual effects of new immigration on incumbent workers might be smaller than aggregate regional effects, because they are to a large extent shielded from new competition, in contrast to new labor market entrants that are not covered by this analysis. Regional mobility is another potentially important adjustment mechanism that is not captured by this individual analysis, hence it is less obvious that immigration shocks necessarily have negative impacts.

FIGURE 4.11: DECOMPOSITION OF IMMIGRANT-NATIVE WAGE GAPS: RECRUITED WORKERS FROM TURKEY

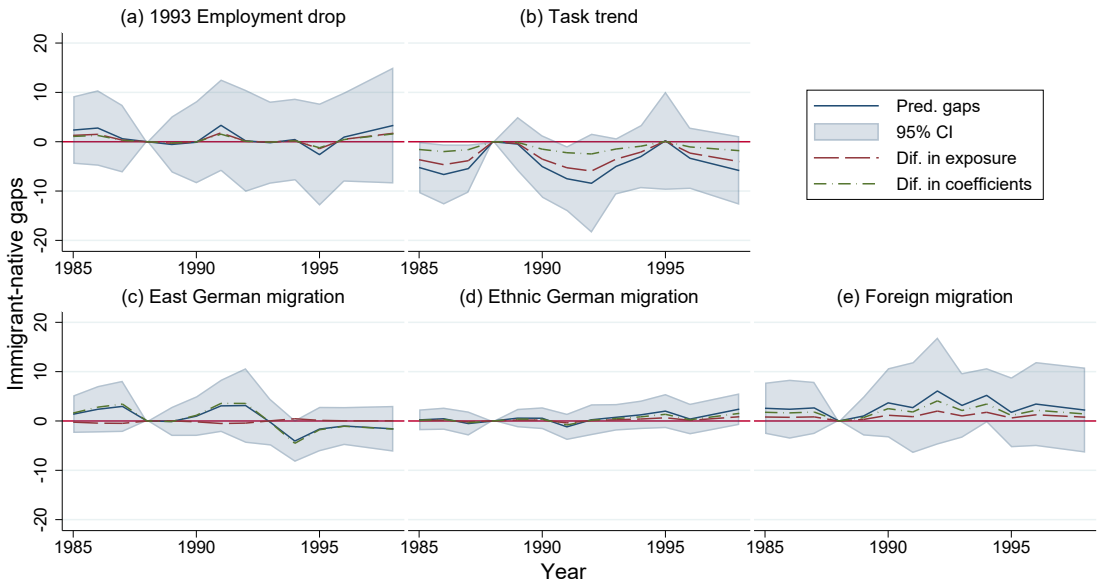
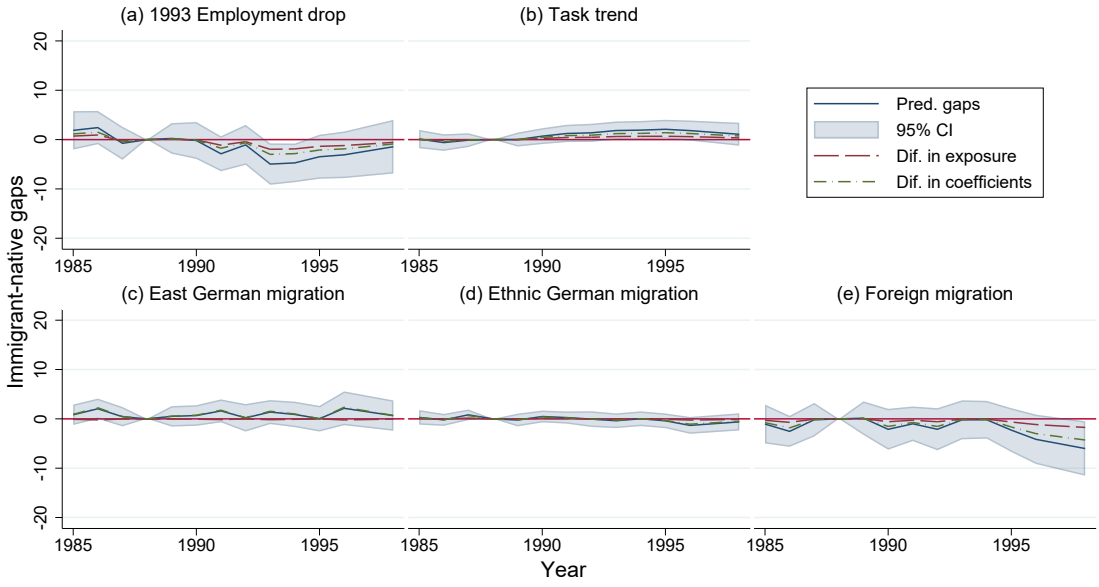


FIGURE 4.12: DECOMPOSITION OF IMMIGRANT-NATIVE WAGE GAPS: LATER ARRIVALS FROM TURKEY



Notes: Oaxaca-Blinder decompositions according to equations (4.4) and (4.5), including individual fixed effects, occupation group × region × time fixed effects and occupation × time fixed effects. The estimation sample includes natives and Turks, covering the years 1985-1998. IV estimates, instrumenting foreign and East German immigration as well as the recession shock, as outlined in Section 4.6.2. Standard Errors clustered on the occupation group × region level.

attributed to the employment drop triggered by the recession around 1993, and after 1994 to foreign immigration. On the other hand, economic shocks did not have a significant impact on the wage gaps of older recruited workers, as shown by the lack of clear or statistically significant effects in Figure 4.11.[22] Two questions emerge from this finding:

Why did the wages of younger Turks react more strongly to changing economic conditions compared to those of older migrants who adjusted entirely through the employment margin? One possible explanation is that migrants who are already approaching retirement may lack the incentives, capabilities, and flexibility to acquire new skills and find new jobs. This could result in older migrants becoming trapped in unemployment and welfare dependency, as shown in previous research (Uhlendorff & Zimmermann, 2014; Riphahn et al., 2013). This would cause their average wages to be biased upwards by those who are still employed.[23] Younger individuals, on the other hand, have a stronger incentive to remain in the labor market even if it means accepting lower wages when competing with newly arrived migrants with similar skill sets. This is consistent with evidence by Brücker & Jahn (2011) showing that the wage elasticities of younger workers facing immigration shocks are higher than those of older workers.

Why were younger workers more negatively impacted by supply shocks (like immigration) compared to older workers whose labor market gaps appear to be driven solely by changes in demand (like recession-triggered employment drops)? Incumbent workers may be relatively shielded from supply shocks due to their tenure and work experience, making them resilient towards increasing competition as long as they manage to retain their jobs. However, younger workers and new labor market entrants are more susceptible to competition (see Dustmann et al., 2017). On the other hand, as already pointed out above, older workers may not be capable or willing to remain in the labor market when their jobs disappear due to fading demand, regardless of the level of competition.

The different ways in which economic shocks impact immigrants at different career stages might partly explain why previous studies on the effects of such shocks on immigrants have produced conflicting results.[24]

4.8 Why Were Turks so Different from Other Migrants?

So far, this study examined the reasons for the rapid deterioration of Turkish migrants' labor market outcomes in Germany in the early 1990s in comparison to natives. However, it remains a puzzle why migrants from other countries who also migrated to Germany under the recruitment policy did not experience similar employment and wage declines

[22] I am not greatly concerned by the small but positive effect of the task-trend, as it should be interpreted in conjunction with the negative effect of the related 1993 employment decrease. The positive impact of the task-trend is conditional on that employment in the specific occupation group-regional skill did not change during the 1993 recession.

[23] Although the panel is balanced, wages are conditional on employment, and selection into employment can influence the results.

[24] For example, D'Amuri et al. (2010) found that new immigration has a more negative effect on immigrant wages than on native wages, while Glitz (2012) found similar effects for both groups. Meanwhile, Dustmann et al. (2010) did not find any significant differences in the effects of economic downturns on the wages of immigrants and natives.

(see Appendix Table 4.A8). This section aims to understand how much of the difference in the labor market trajectories of Turkish and non-Turkish migrants can be attributed to return migration, the clustering of Turkish migrants in large co-ethnic communities, and low levels of social integration, including language proficiency.

4.8.1 Selective Return Migration

In following paragraphs, I argue that the tendency of Turkish migrants to remain in Germany and rely on welfare benefits after becoming unemployed may account for up to one third of the widening gaps in labor market outcomes between Turkish and other migrants who were more likely to return home when losing their jobs. The low rate of return migration among Turks was likely a result of the challenging circumstances in their home country during the 1990s.

Table 4.3 compares the characteristics of the Turkish and non-Turkish migrants who permanently left the BASiD sample between 1988 and 1998 to those who stayed. It demonstrates that Turkish migrants were not only less likely to leave the sample and return to their home countries compared to other migrants, but their return migration was also less negatively selected: Only 7% of Turks in the sample left, compared to more than 20% of migrants from other recruitment countries and those Turks who left did not differ significantly in terms of qualification, wages, pre-1988 employment or unemployment experience from stayers. In contrast, non-Turkish leavers where on average negatively selected in terms of education, wages and labor market experience. These return-migration rates and findings are supported by similar evidence from Kuhlenkasper & Steinhardt (2017) based on the SOEP, indicating that these patterns are not specific to the BASiD and not driven by other forms of sample attrition, such as entering self-employment. Appendix Section 4.A.3 provides more detailed evidence that return migration occurred often as a response to job loss. As such, return migration is likely to induce an upward bias in the observed employment rates and wages of non-Turkish immigrants in unbalanced panels like those in Figure 4.3.

To assess the potential importance of selective return migration, Figure 4.13 compares the labor market trajectories of actually observed migrants (solid lines) to a counterfactual scenario (dashed lines) where the migrant sample is kept constant in the base year of 1988 and sample leavers as well as missings are imputed with the last available previous labor market outcomes.[25] I am particularly interested in the period from 1988 to 1998, when the labor market gaps begin to widen; but retirement is still minimal (see Appendix Figure 4.A1b). Sub-figure 4.13a shows that accounting for selective return migration reduces the difference in employment rates between Turkish and non-Turkish immigrants by about one third in 1998. On the one hand, this estimate is conservative, as it does not take into

[25] Therefore, migrants who permanently leave the balanced sample between 1988 and 1998 are included, in contrast to the sample used in the previous section. By holding the migrant sample constant as of 1988, I can exclude that the 1983/1984 return policies have a direct impact on different return behavior of Turks vs. other migrants.

TABLE 4.3: COMPARISON OF LEAVERS AND STAYERS 1988-1998

	Turks				Non-Turks			
	Leavers	Stayers	Diff.	t-Stat.	Leavers	Stayers	Diff.	t-Stat.
Age 18-24	32.3	41.3	8.9***	(3.35)	27.0	27.0	0.0	(0.00)
Age 25-39	44.9	41.9	-3.0	(-1.06)	52.5	48.2	-4.2**	(-2.28)
Age 40-54	22.8	16.8	-6.0**	(-2.52)	20.6	24.8	4.2***	(2.78)
Prof. qualification	76.3	75.3	-1.0	(-0.44)	72.7	81.0	8.3***	(5.09)
Last observed wage	87.9	89.2	1.26	(0.36)	82.8	94.7	11.9***	(6.99)
Unempl. experience	0.48	0.41	-0.07	(-1.25)	0.45	0.44	-0.01	(-0.30)
Work experience	7.68	7.40	-0.29	(-0.88)	7.04	9.14	2.10***	(8.74)
Observations	334	4,748			871	4,336		

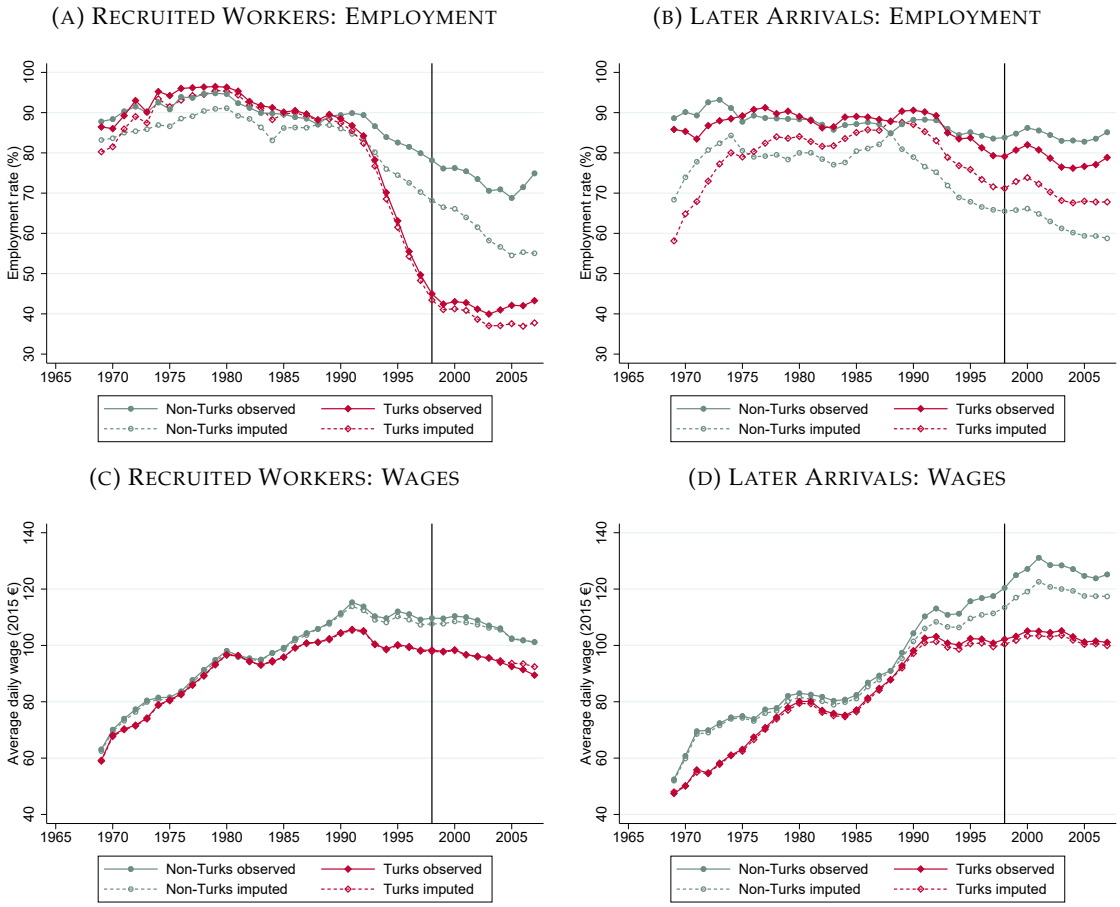
Notes: Immigrants from the recruitment countries who arrived to Germany 1955-1987 in the BASiD (Section 4.3.2). Including individuals non-missing not permanently dropped out in 1988. "Leavers" refers to migrants who permanently dropped out of the sample between 1988 and 1998 and "stayers" to migrants who were still in the dataset in 1999. All covariates are measured in 1988. T-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

account migrants who might have returned home without job loss or unemployment being recorded in the registers. On the other, it represents an upper bound, as some of the migrants who left after losing their job may have found employment again if they had stayed in Germany. Similar patterns are observed for the wages of second-generation immigrants (Sub-figure 4.13d). For explaining employment differences between later arrivals and wage differences between recruited workers, return migration only plays a minor role (as shown in Sub-figures 4.13b and 4.13c).

There are several potential reasons for the differing return migration patterns between Turks and non-Turks. Firstly, the 1980s and 1990s were periods of political instability and unfavorable economic prospects in Turkey, where the Turkish-Kurdish conflict intensified. This hypothesis is supported by Diehl & Liebau (2015) and Kuhlenkasper & Steinhardt (2017), who document a surge in return migration to Turkey after 2000, when the situation in Turkey improved. Secondly, Turks did not have freedom of movement between their home country and Germany, meaning that the decision to return was likely to be final. In contrast, migrants from EU member states and their children always had the option to return to Germany if the labor market prospects improved. This may have made Turks more hesitant to leave Germany. Thirdly, German unemployment and welfare benefits were most generous for Turks in relation to purchasing power in the home country. Finally, Turks were more likely to bring their families to Germany and live in segregated co-ethnic communities (Glitz, 2014), which could increase their social attachments to Germany but also lower their proficiency in the German language and other dimensions of integration (Danzer & Yaman, 2016, 2013).

Interestingly, the differing return behavior of Turks was not reflected in their return intentions before the 1990s. According to the SOEP, the difference in return intentions between Turks and non-Turks in 1987 is statistically insignificant, and if anything, the share of non-Turks who intended to stay in the long term was slightly higher (Appendix Table 4.A3). This indicates that Turks were initially willing to return to their home country, but

FIGURE 4.13: OBSERVED AND IMPUTED LABOR MARKET OUTCOMES



Notes: The observed employment rates and wages exclude missing observations and immigrants that have permanently left the sample. In the outcomes of missings and sample leavers are imputed with the last observed labor market outcome (coding unemployed migrants as not working).

were unable to do so. A theoretical framework proposed by Adda et al. (2022) on the dynamics of return migration can help to understand how return migration may have contributed to the poor labor market performance of Turkish migrants: with the intention to return to their home country soon, most of the so-called "guest workers" invested little in host-country specific capital during the first years in Germany. When, contrary to their previous expectations, return migration turned out to be undesirable for Turks due to conflicts and bad economic prospects in their home country, they lacked the skills to find good jobs in Germany and performed worse than other migrants who were able to realize their initial plans, either by returning or by investing more in human capital from the beginning.

4.8.2 Enclaves, Language and Family Structure

In this section, I provide evidence that differences in co-ethnic communities, language proficiency, and family structure between Turkish and other migrants does not account for a significant portion of the disparities in their labor market outcomes.

Previous research indicates that living in ethnic enclaves can negatively impact the labor market outcomes of migrants (Glitz, 2014; Battisti et al., 2021) and reduce their social integration, including proficiency in the host country's language (Aldashev, Gernandt & Thomsen, 2009; Danzer & Yaman, 2013, 2016). Poor language skills and limited access to native networks may obstruct migrants' ability to find new employment opportunities (Uhlendorff & Zimmermann, 2014; Illing & Koch, 2021) and make them more vulnerable to competition from recently arrived immigrants. Turks in Germany are likely to be particularly affected, as they are among the the most segregated migrant groups in Europe (Glitz, 2014) and tend to have larger families, marry within their ethnic community, and possess weaker language skills compared to other migrant groups (Constant et al., 2012).

In order to analyze the impact of ethnic enclaves, I merge the 1988 regional share of the co-ethnic population with the sample of recruited workers in the BASiD.[26] To study the impact of individual language skills, social networks, detailed family structure, and health, which can serve as proxies for the employability of immigrants, I use survey data from the SOEP and a similar sample of recruited workers.[27] The first column of Table 4.4 ("Base specification") shows the regression coefficient of the average employment rate of individuals between 1994 and 2001 on a dummy variable for Turkish migrants, while controlling only for a full set of age indicators. The coefficients represent the unconditional employment gap between Turkish and other migrants and are consistent in both the BASiD and SOEP datasets (-22.6 and -21.4 percentage points respectively). The second column ("Full specification", includes additional covariates on enclaves, language proficiency or family structure as well as region and occupation group dummies, which results in a reduction of the gap by nearly half. The third column uses a decomposition method by Gelbach (2016) to break down the difference between these two gaps into components that account for the role of intercorrelated covariates and are not affected by the sequence of adding them.

Panel (A) shows that the impact of ethnic enclaves is minor after controlling for occupation and region dummies, which together account for more than 10 percentage points or 80% of the explained difference. Since I control for regional dummies, the only remaining variation in co-ethnic enclaves is between country-of origin groups. Despite the ethnic-enclave component having a negative sign as expected, it is not statistically significant. Thus, the analysis does not support the hypothesis that Turks the higher sensitivity of Turks to economic shocks stems in the first place from living in large co-ethnic communities. The results of analyzing the impact of ethnic enclaves on the *wages* of recruited workers are similar to the results for employment rates, as displayed in Appendix Table 4.A9. For younger cohorts in the BASiD sample, however, ethnic enclaves are the largest contributor to wage differences , though not statistically significant (panel C). This suggests that for younger Turks, being part of an ethnic enclave and having limited access to

[26] Co-ethnic employment share measured in the BASiD on the level of labor market regions. Alternatively, I can also merge co-ethnic employment share in 1973, the year of the recruitment stop from printed volumes of the "Amtliche Nachrichten der Bundesanstalt für Arbeit", which yields very similar results.

[27] I make the sample similar to the BASiD by keeping only males born in 1940 or later that arrived to Germany in 1973 or before.

TABLE 4.4: DECOMPOSITION OF TURKISH VS. NON-TURKISH EMPLOYMENT GAPS

	Specification				Explained	
	Base		Full		difference	
Panel (A): BASiD (Recruited Workers)						
Dummy: Turks	-22.60***	(1.64)	-10.37***	(2.77)	-12.23***	(2.35)
Age	yes		yes			
Occupation	no		yes		-4.72***	(1.37)
Region	no		yes		-5.56	(3.38)
Education	no		yes		0.47**	(0.22)
Children	no		yes		-0.09	(0.07)
Ethnic enclaves	no		yes		-2.33	(3.74)
Observations	2,053		2,053		2,053	
Panel (B): SOEP (Recruited Workers)						
Dummy: Turks	-21.39***	(3.25)	-11.16***	(3.30)	-10.23***	(2.92)
Age	yes		yes			
Occupation	no		yes		-8.99***	(2.54)
Region	no		yes		-0.36	(0.90)
Education	no		yes		-0.43	(0.45)
Return intentions	no		yes		-0.16	(0.23)
Family	no		yes		0.80	(1.03)
Language	no		yes		-0.12	(0.41)
Health	no		yes		-0.96*	(0.56)
Observations	515		515		515	

Notes: Decomposition as proposed by Gelbach (2016): The observation units are individuals. Outcomes are measured as the mean over the period 1994-2001; Occupations and regions are measured in the base year 1988 and all other covariates in the first non-missing year since 1994. All specifications include a full set of birth years to control for age. "Occupations": A full set of indicators for the 176 occupations used by Maier (2021); "Regions": A full set of indicators for labor market regions (BASiD) or for federal states in (SOEP); "Education": Dummies for holding a vocational degree and holding an academic degree; "Children": Dummies for having one child, two children or more than two children; "Ethnic enclaves": The population share of co-nationals in the labor market region in 1988 and the total population share of migrants from the recruitment countries; "Return intentions": Three categories on how long the respondent is planning to stay in Germany; "Family": An indicator for intermarriage, having one, two or more children as well as a dummy for receiving childrens' allowance ("Kindergeld"); "Language": Three categories of self-assesed spoken command of German; "Health": An indicator for receiving a disability pension at any point and the yearly share of days not worked because of illness.

native networks may increase their vulnerability to competition from new immigrants, as outlined in Section 4.7.2. On the other hand, for older individuals, the influence of ethnic enclaves and access to networks does not seem to have a negative impact.

Also in the SOEP sample (panel B), the largest share of the employment gap is explained by the individual's occupation, whereas other factors such as return intentions,

family structure (including number of children, marriage status, and intramarriage), self-reported language skills in German, and health indicators (such as a dummy for disability and number of days absent due to illness) explain only a small portion of the gap. This result supports findings by Aldashev et al. (2009) who argue that language skills only impact labor market indirectly, namely through occupational choices. On the other side, it is in contrast with evidence from Norway by Bratsberg et al. (2010), who find that disability pensions and welfare incentives for large families played a significant role in the labor market exit of recruited workers.[28]

In conclusion, the results from the analysis of ethnic enclaves, language and family structure suggest that they do not play a significant role in explaining the labor market gaps of Turkish immigrants compared to workers from other recruitment countries.

4.9 Conclusions

This paper investigates the reasons why certain migrant groups experience divergent labor market outcomes compared to natives, rather than assimilating. Specifically, it examines the impact of economic shocks on the integration of migrants, depending on their career stage. Using unique pension data, the study examines the labor market integration of "guest workers", who were recruited by German firms from Turkey and Southern Europe during the 1960s and 1970s. The findings reveal that the employment and wages of Turkish workers dramatically dropped in the early 1990s. The specific timing and circumstances of these events have not been studied in depth thus far. The paper focuses on the role of specific economic shocks that occurred around the fall of the Iron Curtain in causing this decline and why Turkish guest workers were disproportionately affected compared to other migrant groups.

Already a descriptive analysis reveals that the experiences of older and younger Turks in the 1990s differed: While the older generation of recruited workers experienced mainly a huge decline in employment rates (dropping from about 80 percent to 40 percent within about six years, regardless of retirement), younger migrants who had arrived after the recruitment stop also experienced a drop in wages besides a moderate decline in employment. Using an instrumental variable approach and Oaxaca-Blinder decompositions, the study estimates the effects of new immigration, employment drops during the 1993 recession and task-biased technical change on the labor market outcomes of Turkish immigrants. It identifies three main mechanisms that contribute to the sudden deterioration of the Turks' labor market integration: Firstly, all Turks reacted much more sensitively to the aggregate employment drop during the 1993 recession than natives. The older generation of recruited workers was worst off, mostly because they were very unfavorably allocated into low-skilled manual jobs that were most adversely affected. Secondly, increasing competition by new immigration contributed to the decline in wages among younger Turkish workers. Finally, the lack of selective return migration among Turks

[28] There were similar discussions in Germany at the time that many Turkish families lived on children's benefits, "Kindergeld", rather than on labor income Velling (1993).

played a sizable role: Other guest workers tended to return to their home countries when losing their jobs, while Turks were much more likely to stay in Germany and apply for unemployment benefits. In comparison, the size of co-ethnic enclaves, language proficiency and family structure only played minor roles.

These findings have important implications beyond the specific historical context of the so-called "guest workers" in Germany: This study demonstrates that older immigrants may be particularly vulnerable to employment losses during economic downturns, and that their employment prospects may be worse than those of native-born workers or younger immigrants. Additionally, this study highlights the importance of considering the unique challenges faced by immigrants who are unable to return home, such as refugees, and the potential implications of hosting these populations. These findings are relevant for policymakers and researchers in other industrialized countries, where large immigrant populations are aging and may be similarly impacted by economic shocks and structural changes. By providing insights into the specific mechanisms that contribute to the deterioration of labor market outcomes for immigrants, this study can inform the development of targeted policies and support for both younger and older immigrant populations.

4.A Appendix

4.A.1 Methodological Details: Counterfactual Control Groups and Immigrant-Native Gaps

In the same spirit as in Chapter 2, in Section 4.4.1 I focus on unconditional, non-parametric comparisons of immigrant cohorts and similar natives. Specifically, I predict the (individual) immigrant-native gap

$$\hat{y}_i^{gap} = y_i - \hat{y}_i \tag{4.A.1}$$

where y_i is the actual outcome of immigrant i and $\hat{y}_i$ is his counterfactual outcome, defined as the average outcome of natives with the same gender, age, education, observation year as well as last observed occupation and industry. I predict this counterfactual outcome from the regression

$$y_n = \sum_{a=18}^{67} \delta^N A_a + \sum_{t=1965}^{2007} \gamma_t^N \Pi_t + \sum_{t=1965}^{2007} \sum_{a=18}^{67} \zeta_{ta}^N (A_a \times \Pi_t) + \eta^N X_n + \varepsilon_n \tag{4.A.2}$$

where y_n denotes the labor market outcome y for native n, A_a denotes a set of dummy variables for age $a = [18, ..., 67]$, Π_t denotes a set of indicator variables for each calendar year t, and $A_a \times \Pi_t$ are full interactions of age and calendar year. X_n is a vector including indicators for vocational and academic degrees, and full sets of indicators for the last observed 2-digit industry as well as 1-digit occupation groups (see Appendix Tables 4.A4 and 4.A5). For non-employed individuals occupations and industries are imputed from their last observed job. All indicators in X_n are seperately interacted with 5-year age groups and 5-year observation year groups to capture changing labor market structure and returns to education over time and over the lifecycle. For the unconditional comparisons in Figure 4.A2 (dashed lines), X_n is omitted; for the conditional comparisons (dash-dotted lines) included. The superscript N emphasizes that the coefficients are estimated based on our native reference sample (working-age men living in West Germany with German but no other nationality).

4.A.2 First stage

First stage results are shown in Table 4.A1. The estimation is based on the full employment sample and for simplicity only includes the base year 1988 and the year 1998. Since the panel is balanced, first stages for other years are identical. Table 4.A1 indicates that the instruments are very good predictors of the endogenous variables they were intended for. Also, the first stage F-statistics (Kleinbergen-Paap) and Sanderson-Windmeijer F-tests for weak instruments are large, suggesting that the instruments are strong. Not only the predicted foreign migration shock appears to be a very good predictor for the actual foreign migration shock (columns 2 and 4), but also predicted East German and ethnic German migration. This is probably because all immigrant groups worked in similar occupation groups and the migration shocks are therefore correlated (Table 4.2).

TABLE 4.A1: FIRST STAGES

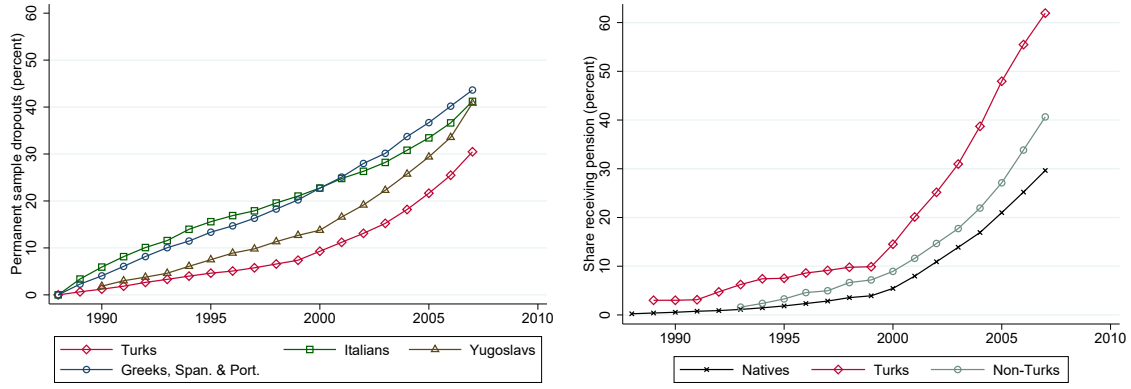
	Recruited workers			Later arrivals		
	Endogenous variable: $shock_{ro} \times D^I \times D^{1998}$					
	East G.	For.migr.	93 Rec.	East G.	For.migr.	93 Rec.
$\widehat{shock}_{ro}^{East\ Germans}$	1.45***	0.52***	-0.13	1.15***	0.51***	-0.08
	(0.20)	(0.20)	(0.34)	(0.09)	(0.14)	(0.19)
$\widehat{shock}_{ro}^{Foreign\ migrants}$	-0.07***	0.48***	-0.08	-0.07***	0.48***	-0.09
	(0.02)	(0.08)	(0.08)	(0.02)	(0.08)	(0.07)
$\widehat{shock}_{ro}^{1993\ recession}$	0.09**	0.08	0.87***	-0.01	-0.04	0.88***
	(0.04)	(0.17)	(0.23)	(0.04)	(0.16)	(0.23)
$shock_{ro}^{Ethnic\ Germans}$	0.13***	0.41***	0.09	0.15***	0.36***	0.05
	(0.05)	(0.11)	(0.15)	(0.04)	(0.09)	(0.12)
$shock_{q}^{task\text{-}trend}$	-0.06**	-0.02	0.07	-0.01	0.06	0.03
	(0.02)	(0.07)	(0.06)	(0.01)	(0.05)	(0.04)
Observations	37,506	37,506	37,506	43,632	43,632	43,632
Kleinbergen-Paap F-stat.	23.37	35.88	36.21	76.84	49.17	45.20
Sanderson-Windmeijer F	68.15	45.62	26.40	129.12	51.34	29.54
Individual FE	×	×	×	×	×	×
Occupation x time FE	×	×	×	×	×	×
Region x time FE	×	×	×	×	×	×
Age & Education controls	×	×	×	×	×	×

Notes: Estimates are based on the employment samples of natives and Turks and include only the base year 1988 and the year 1998. The dependent variables are the endogeneous variables from equation (4.4), $shock_{ro}^{East\ Germans} \times D^I \times D^{1998}$ (columns 1 and 4), $shock_{ro}^{Foreign\ migrants} \times D^I \times D^{1998}$ (Columns 2 and 5), and $shock_{ro}^{1993\ recession} \times D^I \times D^{1998}$ (columns 3 and 6). The explanatory variables (instruments) are also interacted with the migrant dummy, D^I, and the dummy for the year 1998, D^{1998}, but this interaction is not shown for simplicity. Columns (1–3) are based on the sample of recruited workers (migrants from the recruitment countries that started their first job before the recruitment stop in 1973) and columns (4–6) are based on the sample of later arrivals from the recruitment countries. Standard errors clustered by occupation groups × regions. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

4.A.3 Additional Evidence on Return Migration

FIGURE 4.A1: SAMPLE ATTRITION 1988-2007

(A) PERMANENT SAMPLE LEAVERS (ALL MIGRANTS) (B) RETIREMENT (RECRUITED WORKERS)



Notes: Including all migrants that have not permanently left the sample in 1988. Sub-figure (a): Share of permanent sample leavers (counting retirement as dropout) for all migrants from the recruitment countries. Sub-figure (b): Share of retired migrants, including only recruited workers (pre-1973 arrivals).

Figure 4.A1a illustrates that there is no break in the propensity for migrants from the recruitment countries to permanently leave the sample in the early 1990s, but large differences in attrition across origin groups:[29] By 1998, only about 7 percent of those Turks who were living in Germany in 1988 had left the sample in comparison to about 20 percent of migrants from the EU member states Italy, Greece, Spain and Portugal. The sample attrition of Yugoslavs is in between that of Turks and EU citizens.[30] Reassuringly, Kuhlenkasper & Steinhardt (2017) find return migration rates of a very similar magnitude in the SOEP, suggesting that sample attrition in the BASiD adequately captures return migration, and that the differences between nationalities are not driven by other outcomes like self-employment. There are several likely explanations why Turks left Germany less often than migrant workers from European countries: Firstly, Turks were more likely to bring their family and to live in large ethnic enclaves. Secondly, migrating back and forth was relatively easy for EU citizens, while Turks and Yugoslavs usually had to take a definitive decision when leaving Germany. Thirdly, economic prospects and political stability were particularly unfavorable in both Turkey and Yugoslavia that became major refugee sending countries during the 1980s and 1990s.

To provide further evidence that unemployment strongly contributed to the attrition of non-Turks from the sample after 1988, I regress individual characteristics and labor market outcomes in the pooled BASiD panel on a dummy variable that takes the value one if a migrant leaves the sample in the following year. The results, presented in Table

[29] Sample attrition is the best available proxy for return migration, although I cannot observe whether migrants really moved back to their home countries or whether they just left the labor force or became self-employed. Individuals that only receive a pension are counted as dropouts, because pensions can also be paid to people living outside Germany.

[30] By conditioning on those migrants that are still in Germany in 1988, I ensure that Turks who returned in the context of the 1983/84 policies do not bias the results, because they liquidated their pension accounts and are not included in the BASiD.

4.A2, show that the propensity for permanently leaving the sample increases by 5.8 percentage points (or by a factor of 3.2 compared to the average annual propensity of 1.8%) if a migrant has any unemployment experience in a given year, controlling for age, education, and year dummies. Unemployment is the strongest predictor of sample attrition among non-Turks, with a much larger effect compared to Turks. It is worth noting that some migrants may not apply for unemployment benefits in Germany at all if they plan to return to their home country, so this result may be a lower bound.

TABLE 4.A2: INDIVIDUAL CHARACTERISTICS AND PERMANENT SAMPLE DROPOUT

Dependent Variable: Permanent sample dropout (Dummy=100%)	Non-Turks		Turks	
Age 25-39	1.37***	(0.22)	0.35***	(0.12)
Age 40-55	1.61***	(0.28)	0.75***	(0.19)
Age 55+	2.48***	(0.58)	2.26***	(0.55)
Professional qualification	-1.26***	(0.20)	-0.05	(0.09)
Unemployed (Dummy)	5.79***	(0.43)	1.83***	(0.21)
Employment experience	-0.08***	(0.01)	-0.03***	(0.01)
Year dummies	yes		yes	
Observations	51,797		53,932	

BASiD-panel, years 1988-1998, including migrants from the recruitment states arrived before 1988. OLS regressions with individual × year observations (pooled panel). The dependent variable is a dummy that takes the value one if an individual permamently leaves the sample in the following year (dropout event). All coefficients are expressed in percentage points. Regressions include year dummies. Robust standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 4.A3: RETURN INTENTIONS OF NON-TURKISH AND TURKSISH IMMIGRANTS (%)

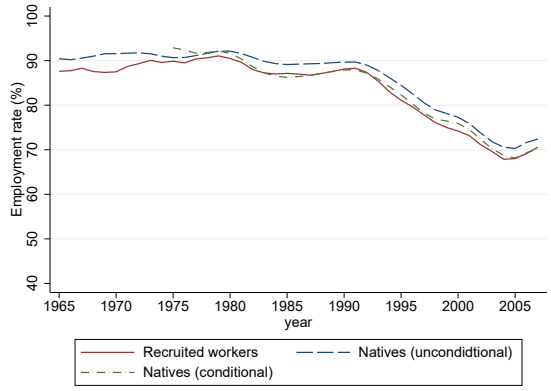
	Non-Turks	Turks	Difference	t-stat.
Return within one year	1.91	1.51	-0.40	(-0.41)
Stay some more years in Germany	63.97	68.11	4.14	(1.10)
Stay in Germany forever	34.11	30.38	-3.74	(-1.00)
N extrapolated	493,547	421,596		
N unweighted	548	320		

Source: SOEP, year 1987, including working-age men from the foreigner sample born between 1940 and 1969. T-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

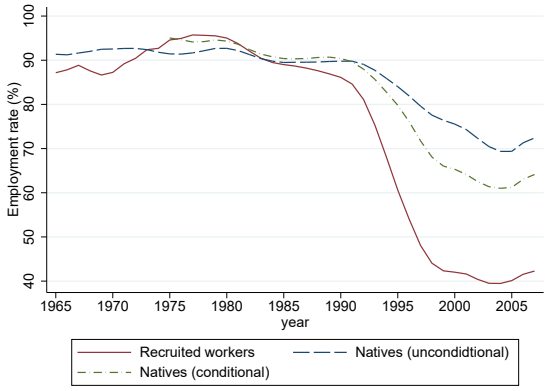
4.A.4 Additional Figures and Tables

FIGURE 4.A2: UNCONDITIONAL AND CONDITIONAL IMMIGRANT-NATIVE GAPS

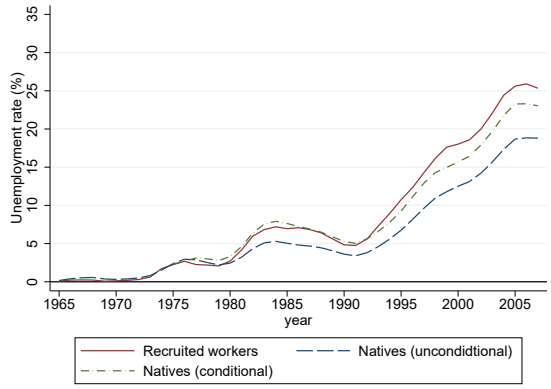
(A) NON-TURKS: EMPLOYMENT



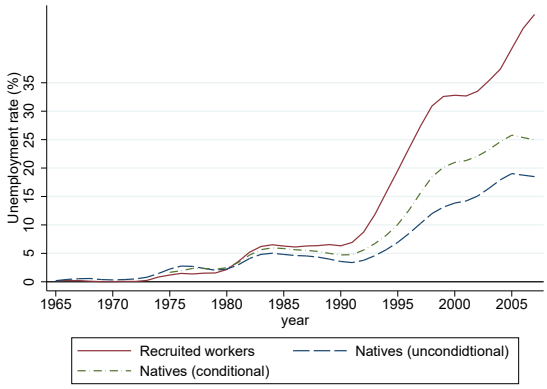
(B) TURKS: EMPLOYMENT



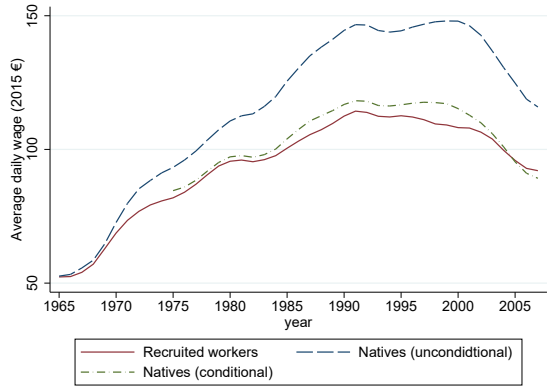
(C) NON-TURKS: UNEMPLOYMENT



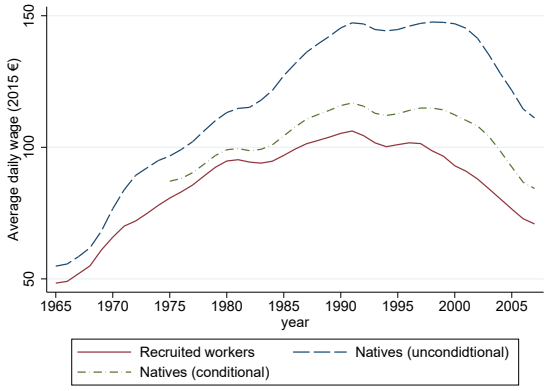
(D) TURKS: UNEMPLOYMENT



(E) NON-TURKS: DAILY WAGES



(F) TURKS: DAILY WAGES



Notes: First generation male recruited workers in the BASiD. Unconditional counterfactuals are predicted for natives with the same age composition as migrants, conditional counterfacutals additionally condition on the education, last occupation and last industry of migrants (see Appendix 4.A.1 for details on the methodology).

TABLE 4.A4: ONE-DIGIT OCCUPATION GROUPS

	Original codes	Label and description
A	1,2	**Simple manual occupations** (mainly unskilled workers or agricultural focus)
B	3	**Qualified manual occupations** (mainly skilled workers)
C	4,5	**Technical & engineering occupations**
D	6	**Simple personal services** (mainly unskilled services)
E	7	**Qualified personal services** (incl. law enforcement & skilled services)
F	8, 9, 12	**Professionals and managers** (academically oriented services, liberal occupations, management)
G	10	**Simple commercial & administrative occupations** (unskilled clerical and trade tasks)
H	11	**Qualified commercial & administrative occupations** (higher administrative and distributive tasks)

Notes: I classify workers into eight occupation groups that are based on the widely-used classification by Blossfeld (1985). I aggregate some occupation groups from the original classification because they contain very little recruited workers.

TABLE 4.A5: TWO-DIGIT INDUSTRY GROUPS

Code	Label
11	Agriculture and fishery
21	Energy and water supply
22	Mining and salt production
23	Quarrying and glass production
31	Chemical industry
32	Metal and steel production
33	Mechanical engineering
34	Vehicle manufacturing
35	Electrical engineering and microelectronics
36	Textile and leather industry
37	Food, beverage and tobacco industry
38	Other manufacturing
41	Construction
51	Wholesale and retail trade
61	Transport and communication
71	Credit, insurance and banking
72	Other commercial services
81	Hospitality industry
82	Education and teaching
83	Health and social services
84	Other personal services
91	Public administration
99	Others

Notes: I aggregate the 1973 version of the German classification of industries (WZ 73) into 23 groups. Reflecting the fact that recruited workers were concentrated in manual industry jobs, the breakdown of industries is relatively more detailed in heavy industries and manufacturing.

TABLE 4.A6: COMPOSITION OF IMMIGRANT COHORTS
(%, YEAR 1975)

	Natives	Turks	Non-Turks
Age groups			
18-24	34.64	4.45	10.34
25-39	65.36	95.55	89.66
40-54	0.00	0.00	0.00
Education			
Professional qualification	89.26	61.93	69.89
Occupations			
Simple manual	16.30	68.17	53.94
Qualified manual	34.48	19.11	29.99
Simple service	15.82	10.38	13.04
Qualified service	33.41	2.34	3.03
Industries			
Agric., mining, quarr.	4.86	15.15	5.41
Chemistry, metal prod.	11.40	24.27	18.48
Mech. /& electr. engin.	19.80	21.01	26.12
Other manufacturing	13.99	16.27	17.41
Construction	11.58	12.45	17.23
Services	38.37	10.86	15.34
Regions			
Northern Germany	21.62	15.73	11.20
North Rhine-Westphalia	28.80	37.30	28.18
Hesse, RLP, Saarland	16.21	15.20	17.33
Baden-Württemberg	15.51	17.16	27.66
Bavaria	17.86	14.61	15.62

Notes: Males in the BASiD born between 1940 and 1955, including only migrants who arrived before the recruitment stop in November 1973. Age groups, education and observation numbers are shown for all individuals in the sample; occupations, industries and regions are conditional on employment. Mechanical and electrical engineering include the automotive industry. Simple services include simple personal services and simple commercial and administrative occupations; Qualified services include technical and engineering occupations, qualified personal services, professionals and managers, and qualified commercial administrative occupations (See Appendix Table 4.A4). Northern Germany includes Schleswig-Holstein, Hamburg, Bremen and Lower Saxony. RLP stands for Rhineland-Palatinate. By composition of the sample, the oldest possible age in the year 1975 is 35 years.

TABLE 4.A7: DECOMPOSITION OF LABOR MARKET GAPS: TURKISH MIGRANTS

	Employment			Wages		
	OLS	RF	2SLS	OLS	RF	2SLS
Panel (A): Recruited workers						
Total predicted gap	-20.61***	-21.28***	-21.56***	-0.96	-0.37	-0.19
	(1.90)	(2.18)	(2.51)	(1.55)	(1.60)	(1.75)
$shock_{ro}^{1993\ recession} \times D^I$	-12.46***	-23.81***	-27.45***	3.93	6.69	8.13
	(3.89)	(7.14)	(9.35)	(2.76)	(5.34)	(7.18)
$shock_{q}^{task\text{-}trend} \times D^I$	-5.11	-0.77	0.30	-7.04**	-8.86**	-9.15**
	(3.46)	(3.98)	(4.24)	(3.32)	(3.76)	(4.13)
$shock_{ro}^{East\ German\ migr.} \times D^I$	3.40**	2.80	2.00	-1.56	-1.98	-1.82
	(1.37)	(2.47)	(2.38)	(1.57)	(2.85)	(2.33)
$shock_{ro}^{Ethnic\ German\ migr.} \times D^I$	-3.78	-1.43	-4.00	3.89**	2.45	2.71
	(2.35)	(2.37)	(2.60)	(1.73)	(1.73)	(1.73)
$shock_{ro}^{Foreign\ migr.} \times D^I$	-2.67	1.93	7.59	-0.19	1.34	-0.06
	(2.95)	(4.22)	(6.85)	(2.16)	(2.93)	(5.05)
Observations	37,506	37,506	37,506	28,926	28,926	28,926
Panel (B): Later arrivals						
Total predicted gap	-7.39***	-7.73***	-7.97***	-5.16***	-5.13***	-5.67***
	(0.85)	(0.71)	(0.90)	(0.86)	(0.86)	(0.94)
$shock_{ro}^{1993\ recession} \times D^I$	-5.39***	-9.19***	-11.21***	-2.77	-0.55	-0.46
	(1.64)	(2.24)	(3.26)	(1.82)	(2.33)	(2.83)
$shock_{q}^{task\text{-}trend} \times D^I$	-0.84	0.71	1.05	1.11	1.26	0.82
	(0.95)	(1.00)	(1.14)	(1.06)	(1.18)	(1.32)
$shock_{ro}^{East\ German\ migr.} \times D^I$	0.90	1.30	1.33	0.61	0.75	1.72
	(0.74)	(0.97)	(1.16)	(0.90)	(1.70)	(1.71)
$shock_{ro}^{Ethnic\ German\ migr.} \times D^I$	-0.73	0.10	-0.54	-1.39*	-1.51*	-0.83
	(0.82)	(0.77)	(0.92)	(0.79)	(0.80)	(0.96)
$shock_{ro}^{Foreign\ migr.} \times D^I$	-1.34	-0.65	1.39	-2.72	-5.08***	-6.92**
	(1.42)	(1.53)	(3.06)	(1.78)	(1.70)	(2.67)
Observations	43,632	43,632	43,632	31,452	31,452	31,452

Notes: Predicted gaps ($\widehat{gap}^{st}$) according to equation (4.5). "RF" refers to reduced form, a regression of the outcome variable on the instruments, without a first stage. Standard errors clustered by occupation groups and labor market regions in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 4.A8: DECOMPOSITION OF LABOR MARKET GAPS: NON-TURKISH MIGRANTS

	Employment			Wages		
	OLS	RF	2SLS	OLS	RF	2SLS
Panel (A): Recruited workers						
Total predicted gap	-1.74	-1.71	-1.77	-0.01	-0.01	0.23
	(1.30)	(1.29)	(1.39)	(1.26)	(1.29)	(1.47)
$shock_{ro}^{1993\ recession} \times D^I$	-1.85	-1.39	-1.91	-1.54	1.80	2.07
	(2.64)	(3.61)	(5.32)	(4.38)	(3.67)	(5.73)
$shock_{q}^{task\text{-}trend} \times D^I$	-1.59	-1.59	-1.53	0.15	-1.06	-0.89
	(1.16)	(1.21)	(1.57)	(2.55)	(2.28)	(2.34)
$shock_{ro}^{East\ German\ migr.} \times D^I$	0.59	1.61	1.58	-0.96	-1.59	-1.84
	(1.50)	(1.71)	(2.00)	(1.14)	(2.50)	(2.57)
$shock_{ro}^{Ethnic\ German\ migr.} \times D^I$	0.52	0.63	0.44	-1.11	-1.33	-1.43
	(1.25)	(1.38)	(1.38)	(1.61)	(1.42)	(1.36)
$shock_{ro}^{Foreign\ migr.} \times D^I$	0.59	-0.97	-0.35	3.45	2.18	2.33
	(2.01)	(2.79)	(5.42)	(2.81)	(2.35)	(5.50)
Observations	37,906	37,906	37,906	29,738	29,738	29,738
Panel (B): Later arrivals						
Total predicted gap	-2.29	-2.49	-2.42	-0.46	-1.41	-2.09
	(0.79)	(0.78)	(0.82)	(1.38)	(1.46)	(1.71)
$shock_{ro}^{1993\ recession} \times D^I$	0.28	-1.26	-1.53	1.10	6.31**	11.45**
	(1.15)	(1.57)	(2.44)	(2.64)	(2.99)	(5.15)
$shock_{q}^{task\text{-}trend} \times D^I$	-0.64	-0.57	-0.43	0.91	0.29	-0.37
	(0.35)	(0.39)	(0.44)	(0.68)	(0.69)	(0.84)
$shock_{ro}^{East\ German\ migr.} \times D^I$	-0.71	-1.18	-2.01	-0.64	-3.40	-2.01
	(0.92)	(1.09)	(1.45)	(1.75)	(2.19)	(2.92)
$shock_{ro}^{Ethnic\ German\ migr.} \times D^I$	-1.32	-1.16	-1.27	-0.43	-0.45	1.58
	(0.67)	(0.66)	(0.75)	(1.23)	(1.22)	(1.44)
$shock_{ro}^{Foreign\ migr.} \times D^I$	0.10	1.68	2.82	-1.39	-4.16**	-12.74**
	(1.30)	(1.31)	(2.76)	(2.28)	(2.12)	(5.13)
Observations	42,220	42,220	42,220	30,566	30,566	30,566

Notes: Predicted gaps ($\widehat{gap}^{st}$) according to equation (4.5). "RF" refers to reduced form, a regression of the outcome variable on the instruments, without a first stage. Standard errors clustered by occupation groups and labor market regions in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

TABLE 4.A9: DECOMPOSITION OF TURKISH VS. NON-TURKISH WAGE GAPS

	Specification					
	Base		Full		Explained	
Panel (A): BASiD (Recruited workers)						
Dummy: Turks	-12.67***	(1.86)	-5.39*	(2.83)	-7.29***	(2.60)
Occupation	no		yes		-1.95	(1.51)
Region	no		yes		-4.96**	(2.28)
Education	no		yes		0.12	(0.36)
Children	no		yes		-0.02	(0.05)
Ethnic enclaves	no		yes		-0.47	(2.59)
Observations	1,719		1,719		1,719	
Panel (B): SOEP (Recruited workers)						
Dummy: Turks	-10.00***	(2.65)	-3.41	(2.12)	-6.81***	(2.61)
Occupation	no		yes		-6.99**	(2.35)
Region	no		yes		0.54	(0.85)
Education	no		yes		-0.34	(0.34)
Return intentions	no		yes		-0.12	(0.17)
Family	no		yes		0.64	(0.67)
Language	no		yes		0.019	(0.33)
Health	no		yes		-0.33	(0.37)
Observations	515		515		515	
Panel (C): BASiD (Later arrivals)						
Dummy: Turks	-12.01***	(1.28)	-5.20***	(1.72)	-6.59**	(1.57)
Occupation	no		yes		-1.67**	(0.75)
Region	no		yes		0.92	(3.89)
Education	no		yes		-1.84***	(0.42)
Children	no		yes		-0.10	(0.06)
Ethnic enclaves	no		yes		-4.11	(4.02)
Observations	6,940		6,940		6,940	

Notes: See Table 4.4.

Bibliography

Abelshauser, W. (1984). *Der Ruhrkohlenbergbau seit 1945. Wiederaufbau, Krise, Anpassung*. C.H. Beck, München.

Abramovitz, M. (1986). Catching Up, Forging Ahead, and Falling Behind. *The Journal of Economic History*, *46*(2), 385–406.

Adda, J., Dustmann, C., & Görlach, J.-S. (2022). The Dynamics of Return Migration, Human Capital Accumulation, and Wage Assimilation. *The Review of Economic Studies*, *89*(6), 2841–2871.

Akcigit, U., Grigsby, J., & Nicholas, T. (2017a). Immigration and the Rise of American Ingenuity. *American Economic Review*, *107*(5), 327–331.

Akcigit, U., Grigsby, J., & Nicholas, T. (2017b). The Rise of American Ingenuity: Innovation and Inventors of the Golden Age. NBER Working Papers 23047, National Bureau of Economic Research.

Aksoy, C. G., Poutvaara, P., & Schikora, F. (2020). First Time around: Local Conditions and Multi-Dimensional Integration of Refugees. IZA Discussion Papers 13914, Institute of Labor Economics (IZA).

Albert, C., Glitz, A., & Llull, J. (2021). Labor Market Competition and the Assimilation of Immigrants. IZA Discussion Papers 14641, Institute of Labor Economics (IZA).

Aldashev, A., Gernandt, J., & Thomsen, S. L. (2009). Language Usage, Participation, Employment and Earnings: Evidence for Foreigners in West Germany with Multiple Sources of Selection. *Labour Economics*, *16*(3), 330–341.

Algan, Y., Dustmann, C., Glitz, A., & Manning, A. (2010). The Economic Situation of First and Second-Generation Immigrants in France, Germany and the United Kingdom. *Economic Journal*, *120*(542), F4–F30.

Amior, M. & Stuhler, J. (2022). Immigration and Monopsony: Evidence across the Distribution of Firms.

Andrews, I., Stock, J. H., & Sun, L. (2019). Weak Instruments in Instrumental Variable Resgression: Theory and Practice. *Annual Reviews of Economics*, *11*, 727–753.

Anger, S., Bassetto, J., & Sandner, M. (2022). Making Integration Work? Facilitating Access to Occupational Recognition and Immigrants' Labor Market Performance. Technical report, IAB-Discussion Paper.

Angrist, J. D. & Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Arbeitskreis VGR der Länder (2021). *Bruttoinlandsprodukt, Bruttowertschöpfung in den kreisfreien Städten und Landkreisen der Bundesrepublik Deutschland 1992 und 1994 bis 2019*. Stuttgart: Statistisches Landesamt Baden-Württemberg.

Arellano-Bover, J. & San, S. (2020). The Role of Firms in the Assimilation of Immigrants. Technical report, Working Paper.

Ashraf, Q., Galor, O., & Ömer Özak (2010). Isolation and Development. *Journal of the European Economic Association*, *8*(2-3), 401–412.

Aus dem Moore, J. P. & Spitz-Oener, A. (2012). Bye Bye, G.I. - The Impact of the U.S. Military Drawdown on Local German Labor Markets. *SFB 649 DP*, (2012-024).

Austin, B., Glaeser, E., & Summers, L. (2018). Jobs for the Heartland: Place-Based Policies in 21st-Century America. *Brookings Papers on Economic Activity*, *2018*(1), 151–255.

Autor, D. H., Dorn, D., Hanson, G. H., & Song, J. (2014). Trade Adjustment: Worker-Level Evidence. *The Quarterly Journal of Economics*, *129*(4), 1799–1860.

Bade, K. J. & Oltmer, J. (2004). *Normalfall Migration*. Zeitbilder; 15. Bonn: Bundeszentrale für politische Bildung.

Bairoch, P. (1990). The Impact of Crop Yields, Agricultural Productivity, and Transport Costs on Urban Growth between 1800 and 1910. In A. van der Woude, A. Hayami, & J. de Vries (Eds.), *Urbanization in history. A process of dynamic interactions*, Urbanization in History (pp. 134–151). Oxford University Press.

BAMF (2017). Das Bundesamt in Zahlen 2016.

Barreto, C., Berbée, P., Torres, K. G., Lange, M., & Sommerfeld, K. (2022). The Civic Engagement and Social Integration of Refugees in Germany. *Nonprofit Policy Forum*, *13*(2), 161–174.

Barro, R. J. & Sala-i Martin, X. (1991). Convergence across States and Regions. *Brookings Papers on Economic Activity*, *22*((1)), 107–182.

Bartels, C., Jäger, S., & Obergruber, N. (2020). Long-Term Effects of Equal Sharing: Evidence from Inheritance Rules for Land. NBER Working Papers 28230, National Bureau of Economic Research.

Barth, E., Bratsberg, B., & Raaum, O. (2004). Identifying Earnings Assimilation of Immigrants under Changing Macroeconomic Conditions. *Scandinavian Journal of Economics*, *106*(1), 1–22.

Basilio, L., Bauer, T. K., & Kramer, A. (2017). Transferability of Human Capital and Immigrant Assimilation: An Analysis for Germany. *LABOUR*, *31*(3), 245–264.

Battisti, M., Dustmann, C., & Schönberg, U. (2022). Technological and Organizational Change and the Careers of Workers. CReAM Discussion Paper Series 25/22, Working Paper.

Battisti, M., Peri, G., & Romiti, A. (2021). Dynamic Effects of Co-Ethnic Networks on Immigrants' Economic Success. *The Economic Journal*, *132*(641), 58–88.

Bauer, T., Dietz, B., Zimmermann, K. F., & Zwintz, E. (2005). German Migration: Development, Assimilation, and Labour Market Effects. In K. F. Zimmermann (Ed.), *European Migration - What Do We Know?* (pp. 197–261). Oxford University Press.

Beerli, A., Ruffner, J., Siegenthaler, M., & Peri, G. (2021). The Abolition of Immigration Restrictions and the Performance of Firms and Workers: Evidence from Switzerland. *American Economic Review*, *111*(3), 976–1012.

Berbée, P., Braun, S. T., & Franke, R. (2022a). Reversing Fortunes of German Regions, 1926-2019: Boon and Bane of Early Industrialization? ZEW Discussion Papers 22-025, ZEW - Leibniz Centre for European Economic Research.

Berbée, P., Braun, S. T., & Franke, R. (2022b). Reversing Fortunes of German Regions, 1926–2019: Boon and Bane of Early Industrialization? IZA Discussion Papers 15463, Institute of Labor Economics (IZA).

Berbée, P., Brücker, H., Garloff, A., & Sommerfeld, K. (2022a). The Labor Demand Effects of Refugee Immigration: Evidence from a Natural Experiment. ZEW Discussion Papers 22-069, ZEW - Leibniz Centre for European Economic Research.

Berbée, P., Brücker, H., Garloff, A., & Sommerfeld, K. (2022b). The Labor Demand Effects of Refugee Immigration: Evidence from a Natural Experiment. IZA Discussion Papers 15833, Institute of Labor Economics (IZA).

Berbée, P. & Stuhler, J. (2023). The Integration of Migrants in the German Labor Market: Evidence over 50 Years. ZEW Discussion Papers 23-020, ZEW - Leibniz Centre for European Economic Research, Mannheim.

Bevelander, P. & Nielsen, H. S. (2001). Declining Employment Success of Immigrant Males in Sweden: Observed or Unobserved Characteristics? *Journal of Population Economics*, *14*(3), 455–471.

Beyer, R. C. M. (2019). Wage Performance of Immigrants in Germany. *German Economic Review*, *20*(4), 141–169.

Blanchflower, D. G. & Oswald, A. J. (1994). *The Wage Curve*. Cambridge, MA: MIT Press.

Blanchflower, D. G. & Oswald, A. J. (2005). The Wage Curve Reloaded. *NBER Working Paper*, (11338).

Blossfeld, H.-P. (1985). *Bildungsexpansion und Berufschancen: empirische Analysen zur Lage der Berufsanfänger in der Bundesrepublik*. PhD thesis, Campus-Verlag.

Bodvarsson, Ö. & Van den Berg, H. (2006). Does Immigration Affect Labor Demand? Model and Test. In S. Polacheck, C. Chiswick, & H. Rapoport (Eds.), *The Economics of Immigration and Diversity. Research in Labor Economics 24* (pp. 135 – 166). Emerald Group Publishing Ltd, Bingley.

Bodvarsson, Ö. B., Van den Berg, H. F., & Lewer, J. J. (2008). Measuring Immigration's Effects on Labor Demand: A reexamination of the Mariel Boatlift. *Labour Economics*, *15*(4), 560–574.

Boeri, T. & Brücker, H. (2005). Why Are Europeans so Tough on Migrants? *Economic Policy*, *20*(44), 630–703.

Boppart, T. (2014). Structural Change and the Kaldor Facts in a Growth Model With Relative Price Effects and Non-Gorman Preferences. *Econometrica*, *82*(6), 2167–2196.

Borjas, G. J. (1985). Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants. *Journal of Labor Economics*, *3*(4), 463–489.

Borjas, G. J. (1995). Assimilation and Changes in Cohort Quality Revisited: What Happened to Immigrant Earnings in the 1980s? *Journal of Labor Economics*, *13*(2), 201–245.

Borjas, G. J. (2003). The Labor Demand Curve *is* Downward Sloping: Reexamining the Impact of Immigration on the Labor Market . *The Quarterly Journal of Economics*, *118*(4), 1335–1374.

Borjas, G. J. (2013). The Analytics of the Wage Effect of Immigration. *IZA Journal of Migration*, *2*(22), 1–25.

Borjas, G. J. (2015). The Slowdown in the Economic Assimilation of Immigrants: Aging and Cohort Effects Revisited Again. *Journal of Human Capital*, *9*(4), 483–517.

Borjas, G. J. & Monras, J. (2017). The Labour Market Consequences of Refugee Supply Shocks. *Economic Policy*, *32*(91), 361–413.

Bosetti, V., Cattaneo, C., & Verdolini, E. (2015). Migration of skilled workers and innovation: A European Perspective. *Journal of International Economics*, *96*(2), 311–322.

Brand, A., Allen, L., Altman, M., Hlava, M., & Scott, J. (2015). Beyond Authorship: Attribution, Contribution, Collaboration, and Credit. *Learned Publishing*, *28*(2), 151–155.

Bratsberg, B., Barth, E., & Raaum, O. (2006). Local Unemployment and the Relative Wages of Immigrants: Evidence from the Current Population Surveys. *Review of Economics and Statistics*, *88*(2), 243–263.

Bratsberg, B., Raaum, O., & Røed, K. (2010). When Minority Labor Migrants Meet the Welfare State. *Journal of Labor Economics*, *28*(3), 633–676.

Bratsberg, B., Raaum, O., & Røed, K. (2014). Immigrants, Labour Market Performance and Social Insurance. *Economic Journal*, *124*(580), F644–F683.

Braun, S. T. & Franke, R. (2022). Railways, Growth, and Industrialization in a Developing German Economy, 1829-1910. *The Journal of Economic History*.

Brell, C., Dustmann, C., & Preston, I. (2020). The Labor Market Integration of Refugee Migrants in High-Income Countries. *Journal of Economic Perspectives*, *34*(1), 94–121.

Brücker, H. (2022). War in the Ukraine: Consequences for the Governance of Refugee Migration and Integration. *CESifo Forum*, *23*(04), pp. 41–48.

Brücker, H., Fendel, T., Guichard, L., Gundacker, L., Jaschke, P., Keita, S., Kosyakova, Y., & Vallizadeh, E. (2020). Fünf Jahre "Wir schaffen das" Eine Bilanz aus der Perspektive des Arbeitsmarktes. IAB-Forschungsbericht 11, IAB - Institute for Employment Research, Nuremberg.

Brücker, H., Glitz, A., Lerche, A., & Romiti, A. (2021). Occupational Recognition and Immigrant Labor Market Outcomes. *Journal of Labor Economics*, *39*(2), 497–525.

Brücker, H., Hauptmann, A., Jahn, E., & Upward, R. (2014). Migration and Imperfect Labor Markets: Theory and Cross-Country Evidence from Denmark, Germany and the UK. *European Economic Review*, *66*(C), 205–225.

Brücker, H., Hauptmann, A., & Jaschke, P. (2020). Beschränkungen der Wohnortwahl für anerkannte Geflüchtete: Wohnsitzauflagen reduzieren die Chancen auf Arbeitsmarktintegration. *IAB-Kurzbericht*, (3/2020).

Brücker, H. & Jahn, E. J. (2011). Migration and Wage-Setting: Reassessing the Labor Market Effects of Migration. *Scandinavian Journal of Economics*, *113*(2), 286–317.

Brücker, H., Kosyakova, Y., & Schuß, E. (2020). Fünf Jahre seit der Fluchtmigration 2015 - Integration in Arbeitsmarkt und Bildungssystem macht weitere Fortschritte. IAB - Kurzbericht 4, IAB - Institute for Employment Research, Nuremberg.

Cadena, B. C., Duncan, B., & Trejo, S. J. (2015). The Labor Market Integration and Impacts of US Immigrants. In *Handbook of the Economics of International Migration*, volume 1 (pp. 1197–1259). Elsevier.

Cantoni, D., Mohr, C., & Weigand, M. (2020). Princes and Townspeople: A Collection of Historical Statistics on German Territories and Cities. 3: Town Charters and First Mentions.

Card, D. (1990). The Impact of the Mariel Boatlift on the Miami Labor Market. *Industrial and Labor Relations Review*, *43*(2), 245–257.

Card, D. (2001). Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration. *Journal of Labor Economics*, *19*(1), 22–64.

Card, D. (2005). Is the New Immigration Really so Bad? *Economic Journal*, *115*(507), 300–323.

Cengiz, D. & Tekgüç, H. (2021). Is It Merely a Labor Supply Shock? Impacts of Syrian Migrants on Local Economies in Turkey. *ILR Review*, *75*(3), 741–768.

Ceritoglu, E., Yunculer, H. B. G., Torun, H., & Tumen, S. (2017). The Impact of Syrian Refugees on Natives' Labor Market Outcomes in Turkey: Evidence from a Quasi-Experimental Design. *IZA Journal of Labor Policy*, *6*(1), 1–28.

Chiswick, B. R. (1978). The Effect of Americanization on the Earnings of Foreign-born Men. *Journal of Political Economy*, *86*(5), 897–921.

Constant, A. & Massey, D. (2005). Labor Market Segmentation and the Earnings of German Guestworkers. *Population Research and Policy Review*, *24*(5), 489–512.

Constant, A. & Massey, D. S. (2003). Self-Selection, Earnings, and Out-Migration: A Longitudinal Study of Immigrants to Germany. *Journal of Population Economics*, *16*(4), 631–653.

Constant, A., Nottmeyer, O., & Zimmermann, K. (2012). Cultural Integration in Germany. In Y. Algan, A. Bisin, A. Manning, & T. Verdier (Eds.), *Cultural Integration of Immigrants in Europe* chapter 3, (pp. 69–124). Oxford University Press.

Czerny, L. (2018). The Fiscal Multiplier of Asylum Seeker Related Spending in Germany. Goethe-University Frankfurt.

D'Amuri, F., Ottaviano, G. I., & Peri, G. (2010). The Labor Market Impact of Immigration in Western Germany in the 1990s. *European Economic Review*, *54*(4), 550–570.

Danzer, A. M. & Yaman, F. (2013). Do Ethnic Enclaves Impede Immigrants' Integration? Evidence from a Quasi-Experimental Social-Interaction Approach. *Review of International Economics*, *21*(2), 311–325.

Danzer, A. M. & Yaman, F. (2016). Ethnic Concentration and Language Fluency of Immigrants: Evidence from the Guest-Worker Placement in Germany. *Journal of Economic Behavior & Organization*, *131*, 151–165.

Daudin, G. (2010). Domestic Trade and Market Size in Late-Eighteenth-Century France. *The Journal of Economic History*, *70*(3), 716–743.

Dauth, W. & Eppelsheimer, J. (2020). Preparing the Sample of Integrated Labour Market Biographies (SIAB) for Scientific Analysis: A Guide. *Journal for Labour Market Research*, *54*(1).

Dauth, W., Findeisen, S., Suedekum, J., & Woessner, N. (2021). The Adjustment of Labor Markets to Robots. *Journal of the European Economic Association*, *19*(6), 3104–3153.

Davidson, R., MacKinnon, J. G., et al. (1993). *Estimation and inference in econometrics*, volume 63. Oxford New York.

de Pleijt, A., Nuvolari, A., & Weisdorf, J. (2020). Human Capital Formation during the First Industrial Revolution: Evidence from the Use of Steam Engines. *Journal of the European Economic Association*, *18*(2), 829–889.

Deaton, A. & Muellbauer, J. (1980). An Almost Ideal Demand System. *The American Economic Review*, *70*(3), 312–326.

Der Spiegel (1984). Harte Politik: Das Handgeld für rückkehrwillige Ausländer hat Bonn gut zwei Milliarden Mark gespart. 38/1984.

DESTATIS (2021). *Datenreport 2021: Ein Sozialbericht für die Bundesrepublik Deutschland*. Bonn: Bundeszentrale für politische Bildung.

Deutscher Bundestag (2017). Unterrichtung durch die Bundesregierung. Finanzplan des Bundes 2017 bis 2021. Drucksache 18/13001.

Diehl, C. & Granato, N. (2018). Germany: Intergenerational Inequalities in the Education System and the Labour Market for Native-Born Children of Immigrants from Turkey and the Former Yugoslavia. In *Catching Up? Country Studies on Intergenerational Mobility and Children of Immigrants* (pp. 71–92). OECD.

Diehl, C. & Liebau, E. (2015). Turning back to Turkey – Or Turning the Back on Germany? *Zeitschrift für Soziologie*, *44*(1), 22–41.

Dippel, C., Ferrara, A., & Heblich, S. (2020). Causal Mediation Analysis in Instrumental-Variables Regressions. *The Stata Journal*, *20*(3), 613–626.

Dippel, C., Gold, R., Heblich, S., & Pinto, R. (2021). The Effect of Trade on Workers and Voters. *The Economic Journal*, *132*(641), 199–217.

Doeringer, P. B. & Piore, M. J. (1971). *Internal Labor Markets and Manpower Analysis*. Routledge.

Dustmann, C. (1993). Earnings adjustment of temporary migrants. *Journal of Population Economics*, *6*(2).

Dustmann, C., Bentolila, S., & Faini, R. (1996). Return Migration: The European Experience. *Economic Policy*, *11*(22), 213.

Dustmann, C., Fasani, F., Frattini, T., Minale, L., & Schönberg, U. (2017). On the Economics and Politics of Refugee Migration. *Economic Policy*, *32*(91), 497–550.

Dustmann, C., Fitzenberger, B., Schönberg, U., & Spitz-Oener, A. (2014). From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy. *Journal of Economic Perspectives*, *28*(1), 167–188.

Dustmann, C. & Frattini, T. (2013). *Immigration, Poverty, and Socioeconomic Inequality*, chapter Immigration: The European Experience, (pp. 423–56). New York: Russell Sage-Foundation.

Dustmann, C., Frattini, T., & Preston, I. P. (2013). The Effect of Immigration along the Distribution of Wages. *Review of Economic Studies*, *80*(1), 145–173.

Dustmann, C., Glitz, A., & Vogel, T. (2010). Employment, Wages, and the Economic Cycle: Differences between Immigrants and Natives. *European Economic Review*, *54*(1), 1–17.

Dustmann, C. & Görlach, J.-S. (2016). The Economics of Temporary Migrations. *Journal of Economic Literature*, *54*(1), 98–136.

Dustmann, C., Schönberg, U., & Stuhler, J. (2016). The Impact of Immigration: Why Do Studies Reach Such Different Results? *The Journal of Economic Perspectives*, *30*(4), 31–56.

Dustmann, C., Schönberg, U., & Stuhler, J. (2017). Labor Supply Shocks, Native Wages, and the Adjustment of Local Employment. *The Quarterly Journal of Economics*, *132*(1), 435–483.

Eckstein, Z. & Weiss, Y. (2004). On the wage growth of immigrants: Israel, 1990–2000. *Journal of the European Economic Association*, *2*(4), 665–695.

Egger, H. & Habermeyer, S. (2022). How Preferences Shape the Welfare and Employment Effects of Trade. *Review of World Economics*, *158*(3), 815–853.

Esposito, E. & Abramson, S. F. (2021). The European Coal Curse. *Journal of Economic Growth*, *26*(1), 77–112.

Fallah, B., Krafft, C., & Wahba, J. (2019). The Impact of Refugees on Employment and Wages in Jordan. *Journal of Development Economics*, *139*, 203–216.

Fasani, F., Frattini, T., & Minale, L. (2021a). Lift the Ban? Initial Employment Restrictions and Refugee Labour Market Outcomes. *Journal of the European Economic Association*, *19*(5), 2803–2854.

Fasani, F., Frattini, T., & Minale, L. (2021b). (The Struggle for) Refugee Integration into the Labour Market: Evidence from Europe. *Journal of Economic Geography*, *22*(2), 351–393.

Fasani, F., Frattini, T., & Pirot, M. (2022). From Refugees to Citizens: Returns to Naturalization and Labour Market Outcomes. Technical report, mimeo.

Felice, E. (2018). Regional Income Inequality in Italy in the Long Run (1871–2010): Patterns and Determinants. In *The economic development of Europe's regions* (pp. 177–203). Routledge.

Fenoaltea, S. (2003). Peeking Backward: Regional Aspects of Industrial Growth in Post-Unification Italy. *The Journal of Economic History*, *63*(4), 1059–1102.

Fernihough, A. & O'Rourke, K. H. (2020). Coal and the European Industrial Revolution. *The Economic Journal*, *131*(635), 1135–1149.

Fertig, M. & Schurer, S. (2007). Labour Market Outcomes of Immigrants in Germany: The Importance of Heterogeneity and Attrition Bias. IZA Discussion Papers 2915, Institute for the Study of Labor (IZA).

Fitzenberger, B., Osikominu, A., & Völter, R. (2006). Imputation Rules to Improve the Education Variable in the IAB Employment Subsample. *Schmollers Jahrbuch: Journal of Applied Social Science Studies/Zeitschrift für Wirtschafts-und Sozialwissenschaften*, *126*(3), 405–436.

Floerkemeier, H., Spatafora, N., & Venables, A. J. (2021). Regional Disparities, Growth, and Inclusiveness. IMF Working Papers 2021/038, International Monetary Fund.

Foged, M., Hasager, L., & Peri, G. (2022). Comparing the Effects of Policies for the Labor Market Integration of Refugees. Technical report.

Foged, M. & Peri, G. (2016). Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data. *American Economic Journal: Applied Economics*, *8*(2), 1–34.

Fortin, N., Lemieux, T., & Firpo, S. (2011). Decomposition Methods in Economics. In *Handbook of Labor Economics* (pp. 1–102). Elsevier.

Fortin, N., Lemieux, T., & Torres, J. (2016). Foreign Human Capital and the Earnings Gap Between Immigrants and Canadian-born Workers. *Labour Economics*, *41*, 104–119.

Franck, R. & Galor, O. (2021). Flowers of Evil? Industrialization and Long Run Development. *Journal of Monetary Economics*, *117*, 108–128.

Frank, H. (1993). *Regionale Entwicklungsdisparitäten im deutschen Industrialisierungsprozeß 1849–1939. Eine empirisch-analytische Untersuchung*. PhD thesis, Westfälische Wilhelms-Universität Münster.

Fremdling, R. (1977). Railroads and German Economic Growth: A Leading Sector Analysis with a Comparison to the United States and Great Britain. *The Journal of Economic History*, *37*(3), 583–604.

Fremdling, R. (1979). Modernisierung und Wachstum der Schwerindustrie in Deutschland, 1830-1860. *Geschichte und Gesellschaft*, *5*(2), 201–227.

Friedberg, R. M. & Hunt, J. (1995). The Impact of Immigrants on Host Country Wages, Employment and Growth. *Journal of Economic Perspectives*, *9*(2), 23–44.

Frodermann, C., Schmucker, A., Seth, S., & Vom Berge, P. (2021). Stichprobe der Integrierten Arbeitsmarktbiografien (SIAB) 1975-2019. FDZ-Datenreport 01/2021, Nürnberg.

Fuchs-Schündeln, N. & Schündeln, M. (2009). Who Stays, Who Goes, Who Returns? *Economics of Transition*, *17*(4), 703–738.

Gathmann, C. & Keller, N. (2017). Access to Citizenship and the Economic Assimilation of Immigrants. *The Economic Journal*, *128*(616), 3141–3181.

Gathmann, C. & Monscheuer, O. (2022). The Labor Market Assimilation of Immigrants in Germany. Unpublished.

Gaubert, C., Kline, P., Vergara, D., & Yagan, D. (2021). Trends in US Spatial Inequality: Concentrating Affluence and a Democratization of Poverty. *AEA Papers and Proceedings*, *111*, 520–525.

Gedaschko, A., Götz, A., Griesbeck, M., Meier, F., Meyer, H., Oltmer, J., Richert, J., Selbach, R., & Rudolf, S. (2016). Flüchtlingsmigration als Bewährungsprobe für Staat und Gesellschaft. In H. Meyer, K. Ritgen, & R. Schäfer (Eds.), *Flüchtlingsrecht und Integration* (pp. 31–96). Kommunal- und Schul-Verlag.

Gelbach, J. B. (2016). When Do Covariates Matter? And Which Ones, and How Much? *Journal of Labor Economics*, *34*(2), 509–543.

Glitz, A. (2012). The Labor Market Impact of Immigration: A Quasi-Experiment Exploiting Immigrant Location Rules in Germany. *Journal of Labor Economics*, *30*(1), 175–213.

Glitz, A. (2014). Ethnic Segregation in Germany. *Labour Economics*, *29*, 28–40.

Grabher, G. (1993). The Weakness of Strong Ties: The Lock-In of Regional Development in the Ruhr Area. In *The embedded firm: on the socioeconomics of industrial networks* (pp. 255–277). London: Routledge.

Greenwood, M. J. & Hunt, G. L. (1984). Migration and Interregional Employment Redistribution in the United States. *The American Economic Review*, *74*(5), 957–969.

Gregory, T., Salomons, A., & Zierahn, U. (2021). Racing With or Against the Machine? Evidence on the Role of Trade in Europe. *Journal of the European Economic Association*, *20*(2), 869–906.

Gundel, S. & Peters, H. (2008). Assimilation and Cohort Effects for German Immigrants. CAWM Discussion Papers 6, Center of Applied Economic Research Münster (CAWM), University of Münster.

Gutberlet, T. (2014). Mechanization and the Spatial Distribution of Industries in the German Empire, 1875 to 1907. *The Economic History Review*, *67*(2), 463–491.

Gürtzgen, N. & Diegmann, A. (2020). Does Low-Pay Persist across Different Regimes? Evidence from German Unification. *Economics of Transition and Institutional Change*, *28*(3), 413–440.

Hamm, R. & Wienert, H. (1990). *Strukturelle Anpassung altindustrieller Regionen im internationalen Vergleich*. Duncker & Humblot.

Hanson, G. & McIntosh, C. (2016). Is the Mediterranean the New Rio Grande? US and EU Immigration Pressures in the Long Run. *Journal of Economic Perspectives*, *30*(4), 57–82.

Hassink, R. & Kiese, M. (2021). Solving the Restructuring Problems of (Former) Old Industrial Regions with Smart Specialization? Conceptual Thoughts and Evidence from the Ruhr. *Review of Regional Research*, *41*(2), 131–155.

Hennig, J. (2019). *Three Essays in Applied Microeconomics*. PhD thesis, Toulouse School of Economics.

Herbert, U. (2001). *Geschichte der Ausländerpolitik in Deutschland : Saisonarbeiter, Zwangsarbeiter, Gastarbeiter, Flüchtlinge*. München: C.H.Beck.

Herrigel, G. (1996). *Industrial Constructions: The Sources of German Industrial Power*. Cambridge University Press.

Hirsch, B., Jahn, E. J., Toomet, O., & Hochfellner, D. (2014). Do Better Pre-Migration Skills Accelerate Immigrants' Wage Assimilation? *Labour Economics*, *30*, 212–222.

Hong, G. & McLaren, J. (2015). Are Immigrants a Shot in the Arm for the Local Economy? *NBER Working Paper*, *21123*.

Hu, X. & Hassink, R. (2016). Explaining Differences in the Adaptability of Old Industrial Areas. In *Routledge handbook of politics and technology* (pp. 162–172). Routledge.

Iammarino, S., Rodriguez-Pose, A., & Storper, M. (2018). Regional inequality in Europe: evidence, theory and policy implications. *Journal of Economic Geography*, *19*(2), 273–298.

IfW (1974). Infrastruktur, räumliche Verdichtung und sektorale Wirtschaftsstruktur als Bestimmungsgründe des regionalen Entwicklungspotentials in den Arbeitsmarktregionen der Bundesrepublik Deutschland. Kiel.

Illing, H. & Koch, T. (2021). Who Suffers the Greatest Loss? Costs of Job Displacement for Migrants and Natives. IAB-Discussion Paper 202108, Institute for Employment Research (IAB), Nuremberg.

Jaeger, D. A., Ruist, J., & Stuhler, J. (2018). Shift-share instruments and the impact of immigration. Technical report, National Bureau of Economic Research.

Jaschke, P., Sardoschau, S., & Tabellini, M. (2021). Scared Straight? Threat and Assimilation of Refugees in Germany. IZA Discussion Papers 14962, Institute of Labor Economics (IZA).

Jones, R. W. (1965). The Structure of Simple General Equilibrium Models. *Journal of Political Economy*, *73*(6), 557–572.

Juhn, C., Murphy, K. M., & Pierce, B. (1993). Wage Inequality and the Rise in Returns to Skill. *Journal of Political Economy*, *101*(3), 410–442.

Junkernheinrich, M. (1989). Ökonomische Erneuerung alter Industrieregionen: Das Beispiel Ruhrgebiet. *Wirtschaftsdienst*, *69*(1), 28–35.

Kaelble, H. & Hohls, R. (1989). Der Wandel der regionalen Disparitäten in der Erwerbsstruktur Deutschlands 1895–1970. In *Schriften des Zentralinstituts für sozialwissenschaftliche Forschung der Freien Universität Berlin* (pp. 288–413). VS Verlag für Sozialwissenschaften.

Kaiserliches Statististisches Amt (1884). Berufsstatistik nach der allgemeinen Berufszählung vom 5. Juni 1882. 1. Berufsstatistik des Reichs und der kleineren Verwaltungsbezirke. *Statistik des Deutschen Reichs. Neue Folge*, *2*.

Kalter, F. & Granato, N. (2002). Demographic Change, Educational Expansion, and Structural Assimilation of Immigrants: The Case of Germany. *European Sociological Review*, *18*(2), 199–216.

Kerr, S. P., Kerr, W., Özden, Ç., & Parsons, C. (2016). Global Talent Flows. *Journal of Economic Perspectives*, *30*(4), 83–106.

Kiese, M. (2019). Strukturwandel 2.0: Das Ruhrgebiet auf dem Weg zur Wissensökonomie? *Standort*, *43*(2), 69–75.

Kiesewetter, H. (1986). Das wirtschaftliche Gefälle zwischen Nord- und Süddeutschland in historischer Perspektive. *Neues Archiv für Niedersachsen : Zeitschrift für Stadt-, Regional- und Landesentwicklung*, *35*(4), 327–347.

Kiesewetter, H. (2004). *Industrielle Revolution in Deutschland. Regionen als Wachstumsmotoren*. Stuttgart: Franz Steiner Verlag.

Kogan, I. (2004). Last Hired, First Fired? The Unemployment Dynamics of Male Immigrants in Germany. *European Sociological Review*, *20*(5), 445–461.

Kogan, I. (2011). New Immigrants - Old Disadvantage Patterns? Labour Market Integration of Recent Immigrants into Germany. *International Migration*, *49*(1), 91–117.

Kogan, I. (2016). Integration Policies and Immigrants' Labor Market Outcomes in Europe. *Sociological Science*, *3*, 335–358.

Kuhlenkasper, T. & Steinhardt, M. F. (2017). Who Leaves and When? Selective Outmigration of Immigrants from Germany. *Economic Systems*, *41*(4), 610–621.

Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review*, *45*(1), 1–28.

LaLonde, R. J. & Topel, R. H. (1991). Labor market adjustments to increased immigration. In *Immigration, Trade and the Labor Market*, NBER Chapters (pp. 167–199). National Bureau of Economic Research, Inc.

Layard, R. & Nickell, S. (1986). Unemployment in Britain. *Economica*, *53*(210), 121–169.

Lee, T., Peri, G., & Viarengo, M. (2022). The Gender Aspect of Migrants' Assimilation in Europe. *Labour Economics*, *78*, 102–180.

Lehmer, F. & Ludsteck, J. (2015). Wage Assimilation of Foreigners: Which Factors Close the Gap? Evidence From Germany. *Review of Income and Wealth*, *61*(4), 677–701.

Lengerer, A., Schroedter, J. H., Boehle, M., & Wolf, C. (2019). *Datenhandbuch GESIS Mikrozensus-Trendfile: Harmonisierung der Mikrozensen 1962 bis 2012*, volume 2019/01 of *GESIS Papers*. Köln: GESIS - Leibniz-Institut für Sozialwissenschaften.

Lewis, E. & Peri, G. (2015). Immigration and the Economy of Cities and Regions. In W. S. G. Duranton, J.V. Henderson (Ed.), *Handbook of Regional and Urban Economics*, volume 5 (pp. 625–685). Elsevier.

Licht, G. & Steiner, V. (1994). Assimilation, Labour Market Experience and Earnings Profiles of Temporary and Permanent Immigrant Workers in Germany. *International Review of Applied Economics*, *8*(2), 130–156.

Lubotsky, D. (2007). Chutes or Ladders? A Longitudinal Analysis of Immigrant Earnings. *Journal of Political Economy*, *115*(5), 820–867.

Lubotsky, D. (2011). The Effect of Changes in the U.S. Wage Structure on Recent Immigrants' Earnings. *Review of Economics and Statistics*, *93*(1), 59–71.

Maier, T. (2021). Change in Occupational Tasks and its Implications: Evidence from a Task Panel from 1973 to 2011 for Western Germany. *Quality & Quantity*, *56*(3), 889–921.

Marbach, M., Hainmueller, J., & Hangartner, D. (2018). The long-term impact of employment bans on the economic integration of refugees. *Science Advances*, *4*(9).

Matheis, M. (2016). Local Economic Impacts of Coal Mining in the United States 1870 to 1970. *The Journal of Economic History*, *76*(4), 1152–1181.

Meng, X. & Gregory, R. G. (2005). Intermarriage and the Economic Assimilation of Immigrants. *Journal of Labor Economics*, *23*(1), 135–174.

Montiel Olea, J. L. & Pflueger, C. E. (2013). A Robust Test for Weak Instruments. *Journal of Business and Economic Statistics*, *31*, 358–369.

Moreno-Galbis, E., Tanguy, J., Tritah, A., & Laffineur, C. (2019). Immigrants' Wage Performance in a Routine Biased Technological Change Era: France 1994–2012. *Industrial Relations: A Journal of Economy and Society*, *58*(4), 623–673.

Muellbauer, J. (1975). Aggregation, Income Distribution and Consumer Demand. *Review of Economic Studies*, *42*(4), 525–543.

Muellbauer, J. (1976). Community Preferences and the Representative Consumer. *Econometrica*, *44*(5), 979–99.

Münz, R. (1997). *Zuwanderung nach Deutschland : Strukturen, Wirkungen, Perspektiven*. Frankfurt New York: Campus Verlag.

Nickell, S. & Andrews, M. (1983). Unions, Real Wages and Employment in Britain 1951-79. *Oxford Economic Papers*, *35*(0), 183–206.

Nickell, S., Nunziata, L., & Ochel, W. (2005). Unemployment in the OECD since the 1960s. What Do We Know? *The Economic Journal*, *115*(500), 1–27.

Nonn, C. (2001). *Die Ruhrbergbaukrise. Entindustrialisierung und Politik 1958-1969*. Göttingen: Vandenhoeck & Ruprecht.

OECD (2013). *Recruiting Immigrant Workers: Germany 2013*. Paris: OECD Publishing.

OECD (2023). OECD Migration Database.

Ottaviano, G. & Peri, G. (2006). Rethinking the Gains from Immigration: Theory and Evidence from the U.S. Knowledge, Technology, Human Capital Working Papers 12073, Fondazione Eni Enrico Mattei (FEEM).

Ottaviano, G. I. & Peri, G. (2012). Rethinking the Effect of Immigration on Wages. *Journal of the European Economic Association*, *10*(1), 152–197.

Persson, J. (1997). Convergence Across the Swedish Counties, 1911–1993. *European Economic Review*, *41*(9), 1835–1852.

Peters, M. (2022). Market Size and Spatial Growth—Evidence from Germany's Post-War Population Expulsions. *Econometrica*, (29329).

Pflueger, C. E. & Wang, S. (2015). A Robust Test for Weak Instruments in Stata. *The Stata Journal*, *15*(1), 216–225.

Pinto, R., Dippel, C., Gold, R., & Heblich, S. (2020). Mediation Analysis in IV Settings with a Single Instrument.

Piopiunik, M. & Ruhose, J. (2017). Immigration, regional conditions, and crime: Evidence from an allocation policy in Germany. *European Economic Review*, *92*(C), 258–282.

Pischke, J.-S. (1992). Assimilation and the Earnings of Guestworkers in Germany. ZEW Discussion Papers 92-17, ZEW - Leibniz Centre for European Economic Research.

Pischke, J.-S. & Velling, J. (1997). Employment Effects of Immigration to Germany: An Analysis Based on Local Labor Markets. *Review of Economics and Statistics*, *79*(4), 594–604.

Prantl, S. & Spitz-Oener, A. (2020). The Impact of Immigration on Competing Natives' Wages: Evidence from German Reunification. *The Review of Economics and Statistics*, *102*(1), 79–97.

RDC (1976-2015). Research Data Centre of the Federal Statistical Office and Statistical Offices of the Länder (RDC), Microcensus 1976-2015, DOI: 10.21242/12211.1976.00.00.3.1.0 - 10.21242/12211.2015.00.00.3.1.0, own calculations.

Reitz, J. G. (2001). Immigrant Success in the Knowledge Economy: Institutional Change and the Immigrant Experience in Canada, 1970-1995. *Journal of Social Issues*, *57*(3), 579–613.

Riphahn, R. T. (2004). Immigrant Participation in Social Assistance Programs: Evidence from German Guestworkers. *Applied Economics Quarterly*, *50*(4), 329–362.

Riphahn, R. T., Sander, M., & Wunder, C. (2013). The Welfare Use of Immigrants and Natives in Germany: The Case of Turkish Immigrants. *International Journal of Manpower*, *34*(1), 70–82.

Rivera-Batiz, F. L. (1982). Nontraded Goods and the Pure Theory of International Trade with Equal Numbers of Goods and Factors. *International Economic Review*, *23*(2), 401–409.

Rivera-Batiz, F. L. (1983). Trade Theory, Distribution of Income, and Immigration. *American Economic Review*, *73*(2), 183–187.

Rodríguez-Pose, A. (2018). The Revenge of the Places that Don't Matter (And what to Do about it). *Cambridge Journal of Regions, Economy and Society*, *11*(1), 189–209.

Rosés, J. R. & Wolf, N. (Eds.). (2018a). *The Economic Development of Europe's Regions*. Routledge.

Rosés, J. R. & Wolf, N. (2018b). The Return of Regional Inequality: Europe from 1900 to Today. VOX, CEPR Policy Portal.

Rosés, J. R. & Wolf, N. (2021). Regional Growth and Inequality in the Long-Run: Europe, 1900–2015. *Oxford Review of Economic Policy*, *37*(1), 17–48.

Sala-i Martin, X. X. (1996). The Classical Approach to Convergence Analysis. *The Economic Journal*, *106*(437), 1019–1036.

Salop, S. C. (1979). A Model of the Natural Rate of Unemployment. *The American Economic Review*, *69*(1), 117–125.

Schmidt, C. M. (1997). Immigrant Performance in Germany: Labor Earnings of Ethnic German Migrants and Foreign Guest-Workers. *The Quarterly Review of Economics and Finance*, *37*(Supplemen), 379–397.

Schrader, K. & Laaser, C.-F. (2019). Unterschiede in der Wirtschaftsentwicklung im Norden und Süden Deutschlands. Kieler Beiträge zur Wirtschaftspolitik 20, Kiel Institute for the World Economy (IfW Kiel).

Shapiro, C. & Stiglitz, J. E. (1984). Equilibrium Unemployment as a Worker Discipline Device. *The American Economic Review*, *74*(3), 433–444.

Spitz-Oener, A. (2006). Technical Change, Job Tasks, and Rising Educational Demands: Looking outside the Wage Structure. *Journal of Labor Economics*, *24*(2), 235–270.

Sprengholz, M., Diehl, C., Giesecke, J., & Kreyenfeld, M. (2021). From "Guest Workers" to EU Migrants: A Gendered View on the Labour Market Integration of Different Arrival Cohorts in Germany. *Journal of Family Research*.

Statistisches Bundesamt (2020a). Bevölkerung und Erwerbstätigkeit. Schutzsuchende. Ergebnisse des Ausländerzentralregisters 2019. Fachserie 1 Reihe 2.4.

Statistisches Bundesamt (2020b). Qualitätsbericht. Ausländerstatistik 2019. Technical report.

Statistisches Bundesamt (2021a). Bevölkerung und Erwerbstätigkeit. Wanderungen 2019. Fachserie 1 Reihe 1.2.

Statistisches Bundesamt (2021b). Wirtschaftsrechnungen. Laufende Wirtschaftsrechnungen. Einkommen, Einnahmen und Ausgaben privater Haushalte. Fachserie 15, Reihe 1. Technical report.

Statistisches Bundesamt (2022). Volkswirtschaftliche Gesamtechnungen. Inlandsproduktberechnung - Detaillierte Jahresergebnisse 2021. Fachserie 18, Reihe 1.4. Technical report.

Statistisches Bundesamt (Destatis) (2019). Bevölkerung und Erwerbstätigkeit 2018. Technical Report Fachserie 1, Reihe 2. Ausländische Bevölkerung. Ergebnisse des Ausländerzentralregisters.

Stegmann, M. (2013). FDZ-Biografiedatensatz aus der Versicherungskontenstichprobe - Methodische Umsetzung des SK79 in einen anonymisierten Datensatz fester Satzlänge: Sequentielle Biografiedaten, Würzburg,. Technical report, FDZ-RV Würzburg.

Steinmayr, A. (2020). Contact versus Exposure: Refugee Presence and Voting for the Far-Right. *Review of Economics and Statistics*, *9790*.

Stock, J. & Yogo, M. (2005). Testing for Weak Instruments in Linear IV Regression. In D. W. Andrews (Ed.), *Identification and Inference for Econometric Models* (pp. 80–108). New York: Cambridge University Press.

Stuetzer, M., Obschonka, M., Audretsch, D. B., Wyrwich, M., Rentfrow, P. J., Coombes, M., Shaw-Taylor, L., & Satchell, M. (2016). Industry Structure, Entrepreneurship, and Culture: an Empirical Analysis Using Historical Coalfields. *European Economic Review*, *86*, 52–72.

Tilly, R. & Kopsidis, M. (2020). *From Old Regime to Industrial State: a History of German Industrialization from the Eighteenth Century to World War I*. Chicago: The University of Chicago Press.

Tumen, S. (2016). The Economic Impact of Syrian Refugees on Host Countries: Quasi-Experimental Evidence from Turkey. *American Economic Review*, *106*(5), 456–60.

Uhlendorff, A. & Zimmermann, K. F. (2014). Unemployment Dynamics among Migrants and Natives. *Economica*, *81*(322), 348–367.

Velling, J. (1993). Immigration to Germany in the Seventies and Eighties: The Role of Family Reunification.

Vonyó, T. (2012). The Bombing of Germany: the Economic Geography of War-Induced Dislocation in West German Industry. *European Review of Economic History*, *16*(1), 97–118.

Weichselbaumer, D. (2019). Multiple Discrimination against Female Immigrants Wearing Headscarves. *ILR Review*, *73*(3), 600–627.

Wendel, K. (2014). Unterbringung von Flüchtlingen in Deutschland. Regelungen und Praxis der Bundesländer im Vergleich. Technical report, Förderverein PRO ASYL e. V., Frankfurt am Main.

Werner, H. (1996). Befristete Zuwanderung von ausländischen Arbeitnehmern. *Mitteilungen aus der Arbeitsmarkt-und Berufsforschung*, *29*(1), 36–53.

Wiedner, J. & Giesecke, J. (2022). Immigrant Men's Economic Adaptation in Changing Labor Markets: Why Gaps between Turkish and German Men Expanded, 1976–2015. *International Migration Review*, *56*(1), 176–205.

Wolf, N. (2018). Regional Economic Growth in Germany, 1895–2010. In J. R. Rosés & N. Wolf (Eds.), *The economic development of Europe's regions* (pp. 149–176). Routledge.

Wunder, C. & Riphahn, R. T. (2013). The Dynamics of Welfare Entry and Exit Amongst Natives and Immigrants. *Oxford Economic Papers*, *66*(2), 580–604.

Yagan, D. (2019). Employment hysteresis from the great recession. *Journal of Political Economy*, *127*(5), 2505–2558.

Young, A. T., Higgins, M. J., & Levy, D. (2008). Sigma Convergence versus Beta Convergence: Evidence from US County-Level Data. *Journal of Money, Credit and Banking*, *40*(5), 1083–1093.

Ziegler, D. (2012). *Die Industrielle Revolution* (3rd ed.). Darmstadt: Wissenschaftliche Buchgesellschaft.

Zierahn, U. (2012). The Effect of Market Access on the Labor Market: Evidence from German Reunification. HWWI Research Paper 131, Hamburg.